

AD-A111 737

ARMY ENGINEER DISTRICT LOUISVILLE KY
WATER RESOURCES DEVELOPMENT MIAMI RIVER, LITTLE MIAMI RIVER, AN--ETC(U)
OCT 81

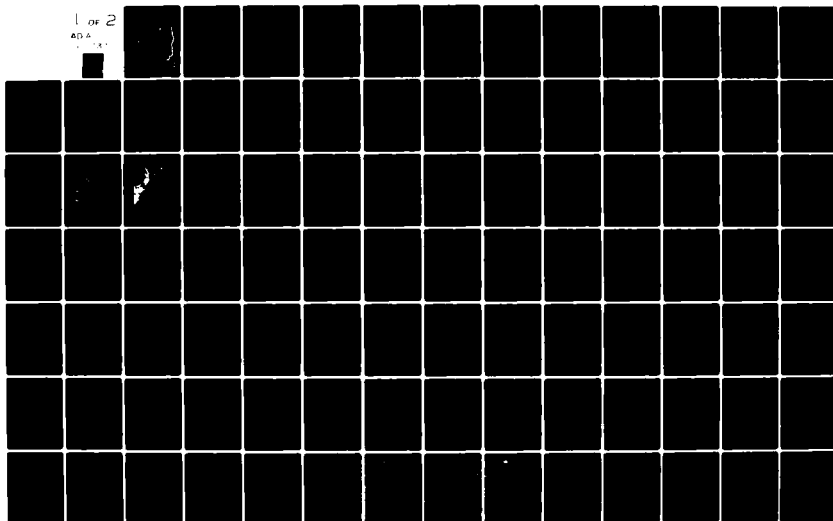
F/G 13/2

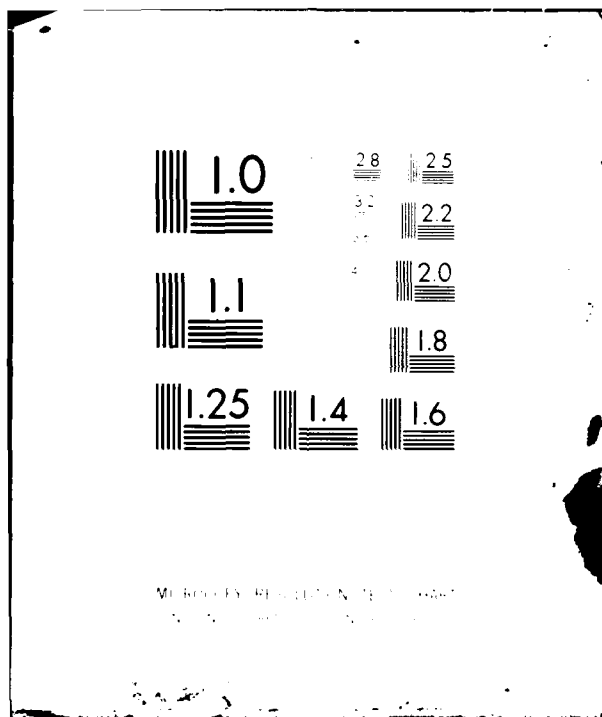
UNCLASSIFIED

NL

1 OF 2

AD A
131 131





Draft

Feasibility

Report

AD A 111737

Main Report

FAIRFIELD

**Southwest
Ohio**

DTIC FILE COPY

**Water
Resources
Development**

This document has been approved
for public release and sale; its
distribution is unlimited.

DTIC
SELECTE
S MAR 8 1982 **D**
A

October 1981

Original contains color
photographs. DTIC reproduction
will be in black and
white.

82 03 05 010

Creek and its tributaries--High School Tributary, General Motors Ditch, and East Fork Tributary. The study area includes the City of Fairfield located in Butler County and the upper reaches of Pleasant Run Creek located in extreme northern Hamilton County.

The significant indentified water and related land resources problems and opportunities in the study area are the direct result of flooding and urban expansion. The most serious problems are caused by headwater flooding on the reaches of Pleasant Run Creek between Miles Road and East Fork Tributary. The flooding on the Great Miami River does not cause significant problems within the study area. Additional outdoor recreation and open space needs exist and opportunities exist for their realization in conjunction with resource requirements for flood control plans.

The tentatively selected plan would substantially lower all floods and protect all affected properties now subject to frequent and severe flooding. The plan would reduce average annual equivalent damages by 97 percent.

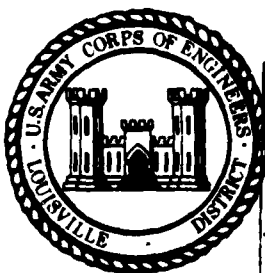
The selected plan includes recreation development at each of the three dry bed reservoir sites. Types of recreation include picnicking, jogging, and biking trails and outdoor games. The recreational development would cost about \$1,140,000 and provide 255,000 annual visitor days of usage.

With a benefit to cost ratio of 1.5 and net benefits of \$581,000 the plan is economically feasible.

INTERIM REPORT FOR WATER RESOURCES DEVELOPMENT MIAMI RIVER, LITTLE MIAMI RIVER, AND MILL CREEK BASINS SOUTHWEST OHIO

A Study to Determine the Feasibility
of Providing Flood Control and
Related Water Resources Improvements
in the Pleasant Run Basin, Ohio

Volume 1 of 2



Accession For	
NTIS GRA&I	<input checked="" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	<input type="checkbox"/>
By _____	
Distribution/	
Availability Codes	
Avail and/or	
Dist	Special
A	

October 1981

This document has been approved
for public release, its
distribution is unlimited.

SYLLABUS

The purpose of this interim report is to present the findings of a study concerning water resources development in the vicinity of Fairfield, Ohio. The study was undertaken as a part of the Miami River, Little Miami River, and Mill Creek Basins, Ohio Survey Investigation. Other water resources studies concerning Southwest Ohio will be reported on in subsequent interim and final reports.

The study includes consideration of water resources along Pleasant Run Creek and its tributaries--High School Tributary, General Motors Ditch, and East Fork Tributary. The study area includes the City of Fairfield located in Butler County and the upper reaches of Pleasant Run Creek located in extreme northern Hamilton County.

The significant identified water and related land resources problems and opportunities in the study area are the direct result of flooding and urban expansion. The most serious problems are caused by headwater flooding on the reaches of Pleasant Run Creek between Nilles Road and East Fork Tributary. The flooding on the Great Miami River does not cause significant problems within the study area. Additional outdoor recreation and open space needs exist and opportunities exist for their realization in conjunction with resource requirements for flood control plans.

After considering and evaluating a large range of alternative plans, including several nonstructural measures, levees, channel improvements, and upstream dry bed reservoirs, the report concluded that three dry bed reservoirs located on Pleasant Run Creek, High School Tributary and East Fork Tributary, along with 1.37 miles of channel widening on Pleasant Run Creek between Nilles Road and East Fork Tributary, was the plan which best met the water resources needs and realized resource opportunities of the Pleasant Run Creek area. The tentatively selected plan consists of dry bed reservoirs at three sites that control upstream runoff and 1.37 miles of channel widening on Pleasant Run Creek that provide a 100-year degree of protection. This plan is environmentally acceptable because of its limited channel

widening, preservation of pool areas, and incorporation of environmentally oriented design concepts to reduce adverse impacts to fish and wildlife habitat. These concepts include the construction of pools and riffles, restriction of channel widening to one bank only where possible, preservation of a wooded area and open space throughout the project area as a part of project requirements including approximately five acres of mitigation lands adjacent to the stream. Any remaining detrimental impacts are considered to be more than offset by the economic and social well being attributes resulting from the flood protection provided by the plan.

The tentatively selected plan would substantially lower all floods and protect all affected properties now subject to frequent and severe flooding. The plan would reduce average annual equivalent damages by 97 percent.

The selected plan includes recreation development at each of the three dry bed reservoir sites. Types of recreation include picnicking, jogging, and biking trails and outdoor games. The recreational development would cost about \$1,140,000 and provide 255,000 annual visitor days of usage.

The tentatively selected plan has an estimated total first cost of \$13,040,000. Average annual economic costs, including operation and maintenance, are estimated at \$1,244,000, and total average annual equivalent benefits are estimated at \$1,825,000. Benefit categories include flood damage reduction and recreation benefits.

With a benefit to cost ratio of 1.5 and net benefits of \$581,000, the plan is economically feasible.

INTERIM REPORT FOR WATER RESOURCES DEVELOPMENT MIAMI RIVER, LITTLE MIAMI RIVER, AND MILL CREEK BASINS SOUTHWEST OHIO

Table of Contents

Item	Page
Syllabus	a
INTRODUCTION	1
Study Authority	1
Scope of the Study	2
Study Participants and Coordination	2
Prior Studies and Reports	4
The Report and Study Process	5
PROBLEM IDENTIFICATION	6
National Objectives	6
Existing Condition	6
Environmental Setting and Natural Resources	6
Human Resources	10
Development and Economy	11
Without Project Conditions	12
Flood Conditions	12
Recreation/Open Space	14
Flood Control Activities	15
Problems, Needs and Opportunities	15
Scoping Activities	18
Planning Constraints	19
NED/EQ Desired Output (Objectives)	20
FORMULATION OF PRELIMINARY PLANS	21
Applicable Water Resource Management Measures	21
Plan Formulation Rationale	22
Analysis of Plans Considered in Preliminary Planning	22
Raise-in-Place	23
Evacuation	24
Relocation	24
Flood Proofing	27
Construction of Small Walls and/or Levees	28
Relocation of Damageable Property Within Existing Structure	28

Table of Contents (Continued)

Item	Page
Floodwalls and Levees	28
Floodwater Diversion	28
Channel Enlargement	28
Dry Bed Reservoirs	30
Additional Combination Plans	37
Comparative Assessment and Evaluation of Preliminary Plans	38
Candidate Plans for Detailed Evaluation	40
Candidate NED Plan	40
Nonstructural Plan	41
Candidate EQ Plan	41
Tradeoff Plan	41
ASSESSMENT AND EVALUATION OF DETAILED PLANS	43
Plan H (NED)	50
Plan Description	50
Impact Assessment	50
Evaluation and Tradeoff Analysis	53
Implementation Responsibilities	53
Cost Apportionment	54
Additional Nonfederal Responsibilities	55
Public Views	56
Plan J	56
Plan Description	56
Impact Assessment	57
Evaluation and Tradeoff Analysis	58
Implementation Responsibilities	59
Cost Apportionment	59
Public Views	59
Plan I (EQ and Nonstructural)	60
Plan Description	60
Impact Assessment	60
Evaluation and Tradeoff Analysis	61
Implementation Responsibilities	62
Cost Apportionment	62
Public Views	62

Table of Contents (Continued)

Item	Page
Plan K (Tradeoff)	63
Plan Description	63
Impact Assessment	64
Evaluation and Tradeoff Analysis	65
Implementation Responsibilities	66
Cost Apportionment	66
Public Views	67
RATIONALE FOR TENTATIVELY SELECTED PLAN	68
General	68
Major Considerations	70
Environmental Considerations	70
Social Well Being Considerations	71
Technical Considerations	72
Economic Considerations	72
Consideration of Executive Order 11988	73
ENVIRONMENTAL IMPACT STATEMENT	

Table of Contents (Continued)

List of Tables

<u>Number</u>	<u>Title</u>	<u>Page</u>
1	Flood Damage Data Summary, Pleasant Run and Tributaries, Fairfield, Ohio	13
2	Raise-in-Place Summary	23
3	Evacuation Summary	25
4	Relocation Summary	26
5	Flood Proofing Summary	27
6	Data Summary, Channel Enlargement Alternatives	31
7	Alternative Reservoir Sites	32
8	Data Summary, Dry Bed Reservoirs plus Channel Enlargement Alternatives	35
9	Major Objectives	39
10	Impact Assessment Summary of Detailed Plans	44
11	Evaluation Summary of Detailed Plans	45
12	Summary of Comparison of Detailed Plans	47
13	Plan H (NED) Economic Summary	53
14	Plan H (NED) Cost Apportionment	54
15	Plan J (Tradeoff) Economic Summary	58
16	Plan J (Tradeoff) Cost Apportionment	59
17	Plan I (EQ and Nonstructural) Economic Summary	61
18	Plan I (EQ and Nonstructural) Cost Apportionment	63
19	Plan K (Tradeoff) Economic Summary	65
20	Plan K (Tradeoff) Cost Apportionment	66
21	Effects of the Tentatively Recommended Plan on Resources of Principal National Recognition	69

Table of Contents (Continued)

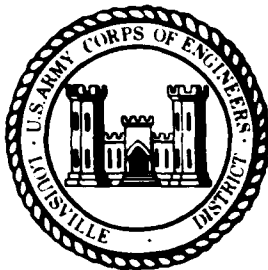
List of Figures

<u>Number</u>	<u>Title</u>	<u>Page</u>
1	General Map	3
2	Study Area Map	7
3	Population Projections	11
4	Average Annual Flood Damages vs Time	14
5	Land Use Map	16
6	Land Use Map	17
7	Reservoir Scoping	34

Table of Contents (Continued)

List of Plates

<u>Number</u>	<u>Title</u>
1	Reaches
2	Initial Channel Enlargement Alternative
3	Dry Bed Reservoirs Considered
4	Three Dry Bed Reservoirs with Channel Enlargement, 100-Year Protection Sheet 1 of 6
	Three Dry Bed Reservoirs with Channel Enlargement, 100-Year Protection Sheet 2 of 6
	Three Dry Bed Reservoirs with Channel Enlargement, 100-Year Protection Sheet 3 of 6
	Dry Bed Reservoir Site "A" Sheet 4 of 6
	Dry Bed Reservoir Site "C" Sheet 5 of 6
	Dry Bed Reservoir Site "D" Sheet 6 of 6



October 1981

INTERIM REPORT FOR WATER RESOURCES DEVELOPMENT MIAMI RIVER, LITTLE MIAMI RIVER, AND MILL CREEK BASINS

INTRODUCTION

This document reports on the feasibility studies for water and related land resources in the vicinity of Fairfield, Ohio. The studies were conducted consistent with the planning requirements of the Water Resources Council's Principles and Standards (P&S), the National Environmental Policy Act of 1969 (NEPA), and related policies. The major sections of this report following the Introduction are: Problem Identification, Formulation of Plans, Assessment and Evaluation of Plans, and Rationale for Tentatively Selected Plan.

The introductory material is furnished to provide the background information for the study. This includes the authority and scope, study participants, related studies, and the format and process for completing this report.

STUDY AUTHORITY

During the late fifties and early sixties, considerable public concern was expressed over water resources problems in the Miami River, Little Miami River, and Mill Creek Basins, Ohio. Subsequently, the U.S. Senators and Representatives from Ohio requested a resolution by Congress for an investigation into flood control and allied improvements. The authority for this study is contained in two resolutions, including U.S. Senate Resolution of 31 May 1967 and U.S. House of Representatives Resolution of 19 October 1967.

The resolution directed a review of prior reports with a view to determining whether improvements for flood control and allied purposes are advisable at the present time in the Miami River, Little Miami River, and Mill Creek Basins in Southwestern Ohio.

SCOPE OF THE STUDY

This interim report addresses water resources problems and opportunities in the vicinity of Fairfield, Ohio. The study effort, as documented herein, includes the results of field investigations, hydrologic and hydraulic studies, economic and environmental studies, Federal, state, and local coordination, and public involvement activities accomplished during the course of the study. Studies were made in the depth and detail necessary for comparison of alternative plans, selection of the most suitable plan, and development of recommendations for implementation.

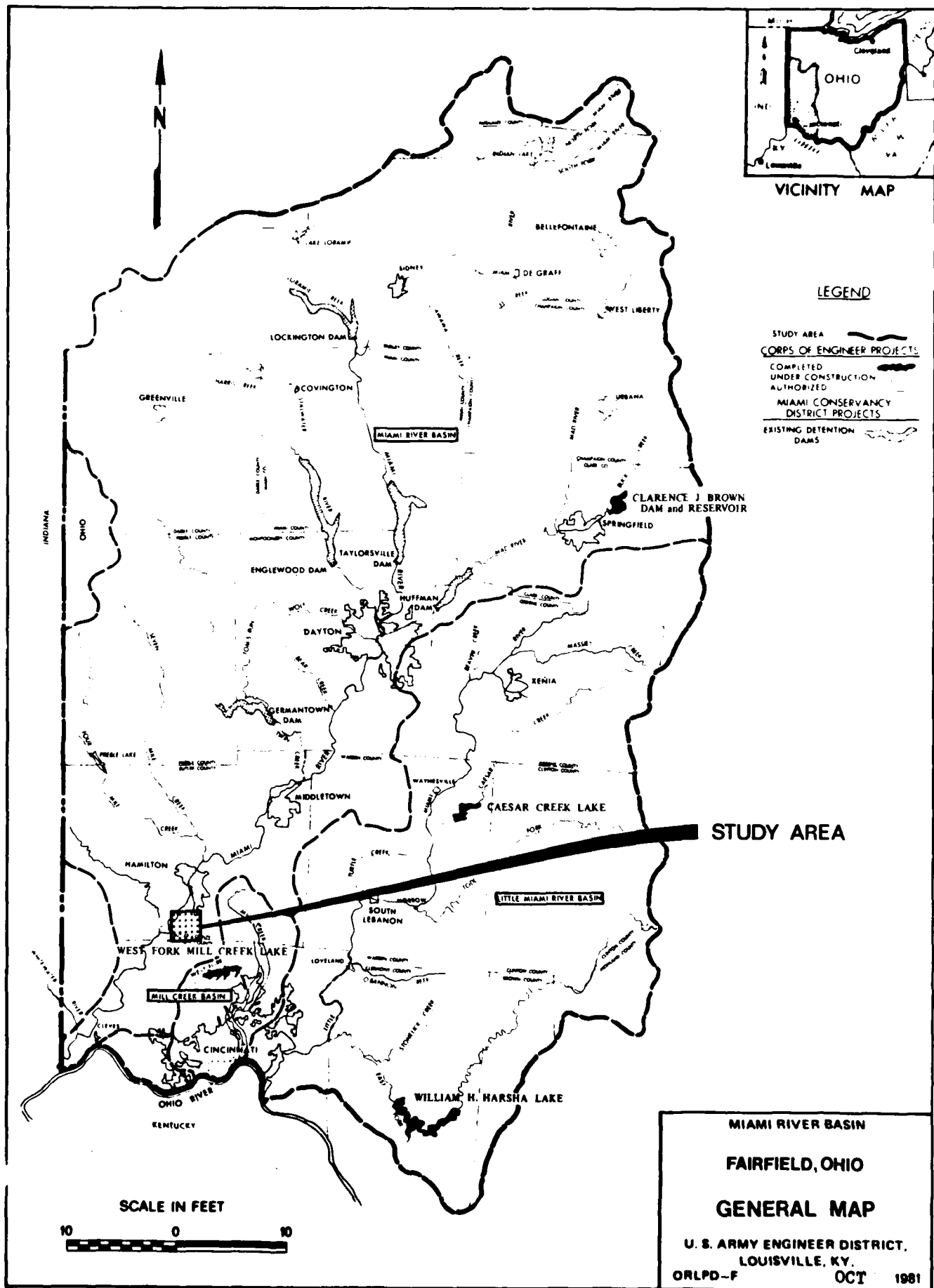
This interim study at Fairfield, Ohio addresses flood damage problems, urban oriented recreation opportunities, and the opportunities for preservation and enhancement of fish and wildlife resources. Opportunities for development of water resources of the study area in the areas of hydropower, navigation, and water supply are limited or nonexistent and therefore were given no further consideration in this interim reporting effort.

The Fairfield, Ohio study area is shown on the General Map (Figure 1) in relation to the Southwest Ohio region.

STUDY PARTICIPANTS AND COORDINATION

An early stage public meeting held near the area (Lebanon) was one of three initial meetings for the parent study. The state, the Miami Conservancy District (MCD), Fish and Wildlife Service, and local officials have been kept informed of efforts for this interim study. Meetings with representatives of MCD, Ohio, and Fairfield were held in June 1975 and November 1977 (period of screening studies for Southwest Ohio study area). Since August 1979, numerous field trips and meetings with the Miami Conservancy District and the City of Fairfield have taken place.

Appropriate letters from the above participants and reports from the U.S. Fish and Wildlife Service are included in Appendix C. The Stage 2 Plan Formulation Stage Public Meeting was held at Fairfield on



20 November 1980. Of the 50 to 55 persons in attendance, only one local property owner expressed concern about increased flooding in the lower reaches, as might result from upstream improvements. Data and information were provided on the full range of alternatives considered and investigated in detail as a result of Stages 1 and 2 of the study. Important input by the public included information relative to the degree of protection, desires for preservation of the stream environment and neighborhoods, and opportunities for recreation. The majority of those present strongly supported the study. Local officials supported the study and indicated their preference for the dry bed reservoir plans with inclusion of recreation. The Stage 3 public meeting is scheduled to be held in the fall of 1981.

PRIOR STUDIES AND REPORTS

Stage 1 screening studies were reported by the Louisville District, Corps of Engineers, in July 1973 for the entire Southwest Ohio region. This effort identified urban flood damage centers and reported on the feasibility of protective measures. The scope of problems and solutions was identified to the extent that certain project areas were considered eligible for the Continuing Authorities Program, while other study areas were prioritized for potential interim reporting efforts under the Corps General Investigation Survey Study Program. Flooding problems on Pleasant Run at Fairfield were contained in the prioritized interim survey study program.

Intensive Stage 2 study effort by the Louisville District began in the summer of 1979. Following the August 1979 flooding on Pleasant Run, the City of Fairfield employed the Miami Conservancy District in a consulting capacity to investigate flood problems and their solutions in the Pleasant Run area. Close coordination and cooperation were maintained between the MCD and the Corps in order to expedite completion of preliminary studies. A preliminary report dated 14 December 1979 and a detailed report dated October 1980 were prepared by MCD. The report included analysis of alternative channel and retention basin plans and

concluded, based on effectiveness and implementability, that a combination of retention basins and channel improvement would provide the best solution to flood problems at Fairfield, Ohio.

THE REPORT AND STUDY PROCESS

Documentation of studies conducted for the Fairfield area is provided by Volume 1, the Main Report, which includes the Environmental Impact Statement (EIS), and Volume 2 containing the Technical Appendices. The Main Report is a nontechnical presentation that presents the results of the survey study. The appendices provide greater detail on the studies accomplished and document the views and comments of others.

This report documents Stage 3 of the survey investigation, and its completion finishes the preauthorization studies for Pleasant Run and the Fairfield area. The report provides the documentation for further review and action by Federal and state decisionmakers. More specifically, the report will be transmitted to and reviewed by the following: Corps of Engineers--Ohio River Division, Board of Engineers for Rivers and Harbors, and Chief of Engineers; Secretary of the Army; Office of Management and Budget; and Congress. The above process includes additional steps to obtain further inputs from the general public and local, state, and Federal agencies. Upon completing this review, the Division Engineer will issue a public notice to all persons known to be interested in the study.

The notice sets forth the findings of the study and invites those who wish to do so to furnish their views and comments to the Board of Engineers for Rivers and Harbors. Depending upon the views and comments received and upon controversial matters, the Board may hold a public meeting during its review of the report. The Chief of Engineers forwards copies of the report to the Governor of Ohio and other interested Federal agencies for formal review and comments. After receipt and consideration of all comments, including the review by the Office of Management and Budget, the Secretary of the Army transmits the report to Congress for action.

PROBLEM IDENTIFICATION

This section includes: (1) identification of the national objectives for water and related land resources planning; (2) an inventory of existing conditions in the study area; (3) definition of the expected future without project conditions; (4) definition of the study area problems and opportunities for resource uses; and (5) conclusions regarding the identification of planning constraints and specific opportunity statements.

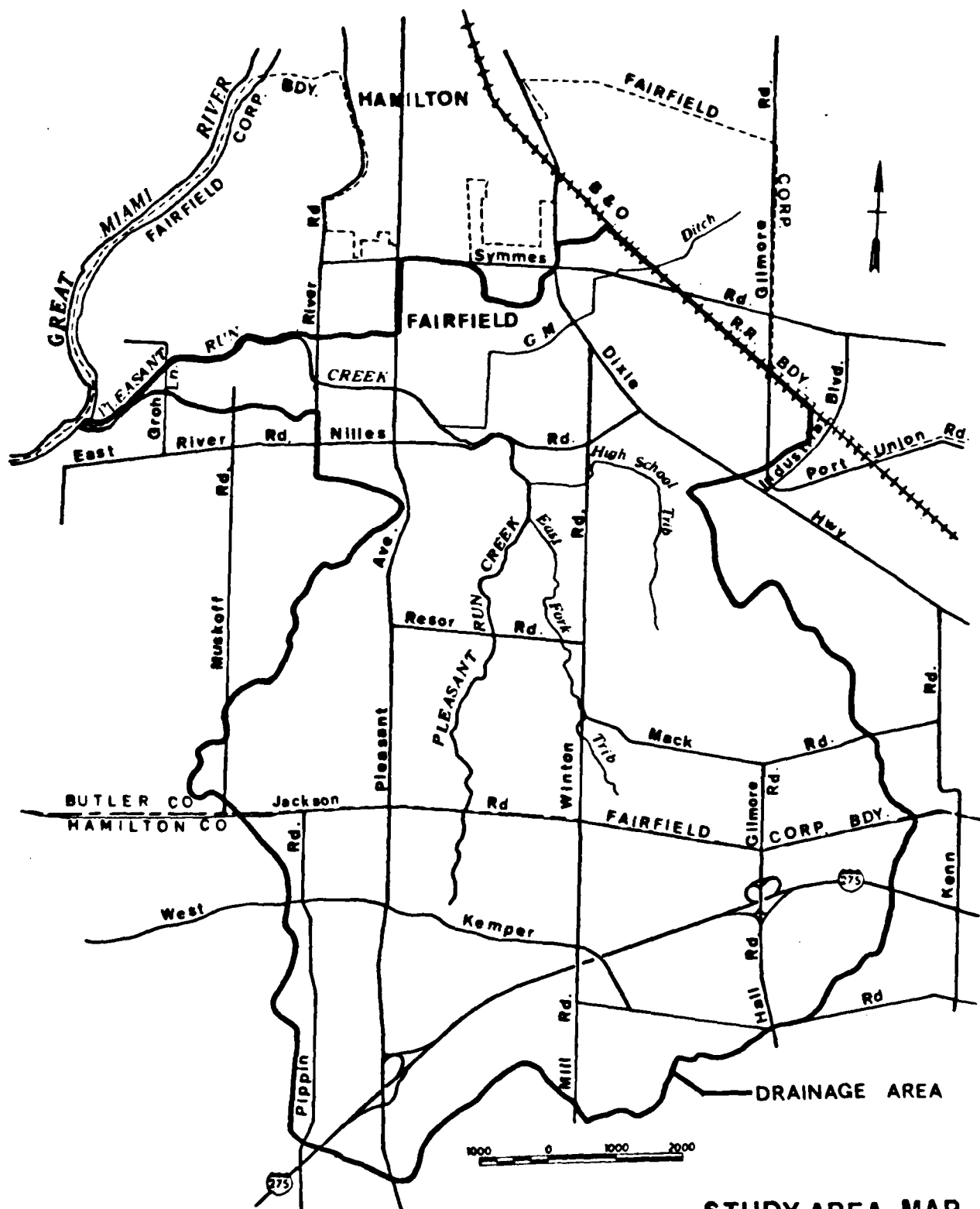
NATIONAL OBJECTIVES

Two national objectives have been established for all water and related land resources planning. They are enhancement of National Economic Development (NED) and Environmental Quality (EQ). NED can be enhanced by improving national economic efficiency and increasing the value of the Nation's output of goods and services. In respect to water resources projects, contributions to NED are made through actions that result in net economic benefits. EQ can be enhanced by management, conservation, preservation, creation, restoration, or improvement of the quality of natural resources and ecological systems. In order to identify the results of efforts to meet these objectives, an alternative will be formulated which reasonably maximizes contributions to the NED objectives, and an alternative will be evaluated that reasonably maximizes the contributions to the EQ objectives.

EXISTING CONDITION

Environmental Setting and Natural Resources

The study area is located in the south-central part of Butler County, with one small area in the upper reaches of Pleasant Run Creek extending southward into Hamilton County (Figure 2). The drainage area of Pleasant Run Creek and its tributaries covers 14.2 square miles. Pleasant Run is a tributary of the Miami River and has its confluence with the Miami at Mile 30.7. The Miami River flows from north to south toward the Ohio River.



STUDY AREA MAP
FAIRFIELD, OHIO

The flood plain of the study area is highly urbanized with relatively small open space and greenbelt strips. In pursuit of open land for housing, industry and commercial activity, developers have utilized much of the suitable land. As a suburb of Cincinnati, the area has experienced rapid growth during the last decade and complete urbanization of the study area is projected by the year 1995.

Topography of the area is characterized by two distinct types of surface configuration, the uplands which consist of low rolling hills and valley bottoms which are broad and nearly level. The uplands have been dissected by small drainageways so that relatively few level sections remain. The slopes over most of the uplands are moderate to steeply rolling. The slopes range from vertical bluffs in areas with rock outcrops to long, more gradual slopes rising to an elevation of 200 feet or more above the valleys. Most of the valley walls have a slope between 10 and 20 degrees.

Pleasant Run Creek flows over a streambed composed primarily of gravel and sand with a number of gravel bars present. The soils are alluvial and terrace soils. Alluvial soils are formed from material washed from higher areas and deposited on the flood plains. They do not have well developed topsoil and subsoil layers as do most upland soils, but often have alternating layers of fine and coarse materials. These soils are generally very productive since sediments rich in plant nutrients, organic matter, and lime are added periodically by floodwaters. This group of nearly level soils is generally not subject to surface erosion. However, streambank and channel erosion sometimes occurs during periods of flooding. Much of these soils are subject to annual flooding which makes them unsuitable for certain types of agricultural use in spite of their productivity. Because of the severe flood hazard, these soils are generally not suitable for development unless protected by levees.

Specific biotic communities encountered along Pleasant Run include old and cultivated fields, woodlot, and riparian flood plain. The extensive diversification exhibited by both woodlot and flood plain communities reflects hydric bottomland conditions. Dominant vegetation

within these natural communities are the more water tolerant tree species consisting of sycamore, boxelder and willow. The riparian forest provides food, cover, and nesting sites for a variety of wildlife. The area supports a number of birds and small mammals. Reptiles and amphibians noted in the area are garter snakes, box turtle, toads, salamanders, frogs, and mudpuppys. The physical characteristics of the stream are adequate to support a diverse fishery although the stream is stressed somewhat by intermittent flows and degraded water supply. The sand and gravel substrate of the stream has a sufficient gradient to maintain a good pool-riffle complex. Based on a survey by the U.S. Fish and Wildlife Service, the following fish species are found in Pleasant Run: smallmouth bass, bluegill, green sunfish, black bullhead, white sucker, creek chub, rock bass and carp.

The Miami River Valley is rich in terms of prehistoric archeological sites, particularly in the number of mounds which the area contains. In Fairfield Township, for example, there are 17 recorded mounds, 7 enclosures, and one prehistoric cemetery. This area has been under settlement since the 18th Century. Fertile soils and flat to gentle topography made this area a major agricultural region in the early 19th Century. To provide improved transportation to agricultural markets, the Miami and Erie Canal was built, which led to a manufacturing boom. The Miami Valley is one of the more important industrial areas of the United States.

Four mounds and one enclosure have been recorded in the Pleasant Run flood plain. The enclosure is located on the Pleasant Run stream-bank in the vicinity of Groh Lane. Due to excavation of these sites and the intensive development in the area, these sites have been destroyed. There are no sites in the project area listed on the National Register of Historic Places. An archeological reconnaissance of the project area revealed no prehistoric or early historic remains.

The area lies in the humid-temperate continental climatic zone. This climate is characterized by large annual and daily changes in weather and temperature as a result of passing fronts and associated high or low pressure centers. Normal average daily temperatures in the

study area vary from 33°F in January, the coldest month, to 76°F in July, the warmest month. Winters are moderately cold with temperatures dropping to near 0°F, while summers are warm with temperatures occasionally rising above 90°F. Prevailing winds are from the southwest with average velocities reaching 8 to 11 miles per hour. Damaging winds of 30 to 80 miles per hour occasionally occur during spring and summer in close association with thunderstorm activity. The annual precipitation over the area averages 39 inches, with most of this occurring during the winter and spring months.

Human Resources

In 1970, the City of Fairfield's population was estimated at 14,680, or 6.5 percent of Butler County's population of 226,207. The 1980 population estimates reflected a 110 percent increase in population for Fairfield (30,816) versus a 14 percent increase for Butler County (258,380). By 1980, Fairfield's population, relative to Butler County's total, increased 12 percent.

Fairfield, located between Hamilton and Cincinnati, Ohio, is experiencing the urban growth pressures from both of these highly urbanized-industrial population centers. Population projections available from OBERS data indicate that a radical attenuation in the growth rate would have to occur in the near future, compared to the 1960-80 period, in order to meet OBERS projections (see Figure 3). Comparison of land development rates over the 1960-80 period with actual population growth, and supported by coordination with local planning and zoning commissions, indicates that 90 percent of the Pleasant Run drainage area will ultimately be developed and that such will occur by the year 1995. An attenuation of growth prior to that time would not reasonably be expected.

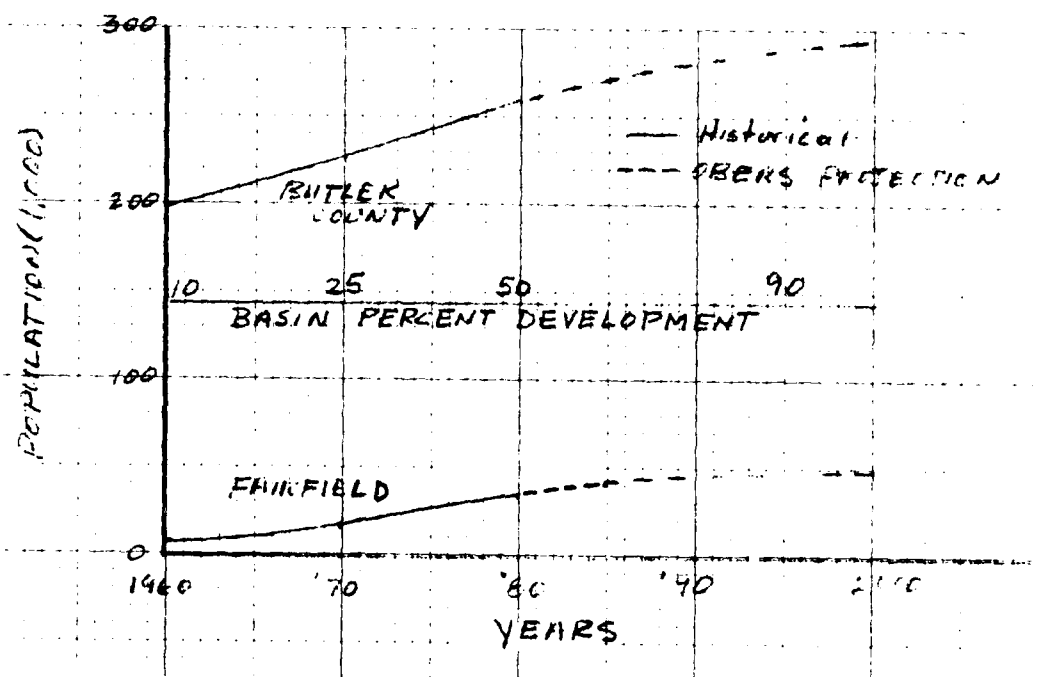


FIGURE 3. Population Projections

Development and Economy

The economy of Butler County is characterized by strong activities in manufacturing and a moderate shift from the production of goods to services. Recent industrial activity indicates that the production of export goods for local consumption is increasing, while the production of export goods is not declining except in the percentage of total production. Meanwhile, services in general and finance, insurance, and real estate, in particular, have achieved phenomenal growth.

Although the economy of the Hamilton-Middletown Standard Metropolitan Statistical Area (SMSA) is considered developed and mature, the economy of Fairfield exhibits dynamic features typical of a growing economy. The development potential and available land areas will sustain the employment and income needs of an expanding labor force and a growing population.

During the period 1970-1977, the City of Fairfield had a total employment increase of over 100 percent, compared to an employment increase in Butler County of 13 percent. Per capita and median family incomes at Fairfield compare to estimates for Butler County, the state, based on 1980 data.

The City of Fairfield is served by Interstate Highway 275, Ohio Route 4, Bypass 4, and U.S. Highway 127. Fairfield is also served by railroad--Chessie Railroad System--and air via the Hamilton Airport and the Greater Cincinnati Airport (30 miles to the south).

WITHOUT PROJECT CONDITIONS

The definition and establishment of without project conditions provides the future base condition against which problems, needs, and opportunities are defined and beneficial and adverse effects of alternative actions are measured. Characteristics of the study area pertinent to establishment of needs and evaluation of effects include future flood conditions, recreation supply and demand, land use, and planned actions. These significant characteristics of the study area are discussed below.

Flood Conditions

The potential for flood damage along Pleasant Run and its tributaries in the Fairfield area is evidenced by data in Table 1. Damage estimates for various flood heights, stated in terms of frequency of occurrence, are shown as ranging from \$5.3 to \$10.6 million by 1995 under without project conditions. Average annual flood damages, shown in Figure 4, are shown to increase from \$443,000 annually in 1980 to \$1,260,000 by the year 2005. The future most probable without project condition is based on no future development in the 100-year flood plain and continued urbanization and development of the basin drainage area--reaching 90 percent development by 1995.

Without project conditions further assume the completion of ongoing actions by local interests for implementation of the flood insurance program and necessary flood plain zoning.

TABLE 1

FLOOD DAMAGE DATA SUMMARY ^{1/}
 PLEASANT RUN AND TRIBUTARIES
 FAIRFIELD, OHIO

Item	SPF	500	100	25
Area (Acres)	987	876	722	598
Number of Units				
Residential ^{2/}	1,126	1,014	899	682
Commercial	43	37	30	23
Property Value (\$1,000)				
Residential ^{3/}	73,200	65,800	58,900	46,500
Commercial ^{3/}	6,500	6,100	4,900	4,000
Transportation	10,700	9,200	7,500	4,700
Utilities	6,800	6,500	6,200	5,700
Total Value	97,200	87,600	77,500	60,900
Damage (\$1,000)				
Residential	9,620	8,780	6,910	4,900
Commercial	380	320	280	150
Transportation	510	420	290	210
Utilities	120	100	90	60
Total Damage	10,630	9,620	7,570	5,320

^{1/} 1980 development, 1995 hydrologic conditions, October 1980 values

^{2/} Includes apartments

^{3/} Includes value of structures, contents, grounds

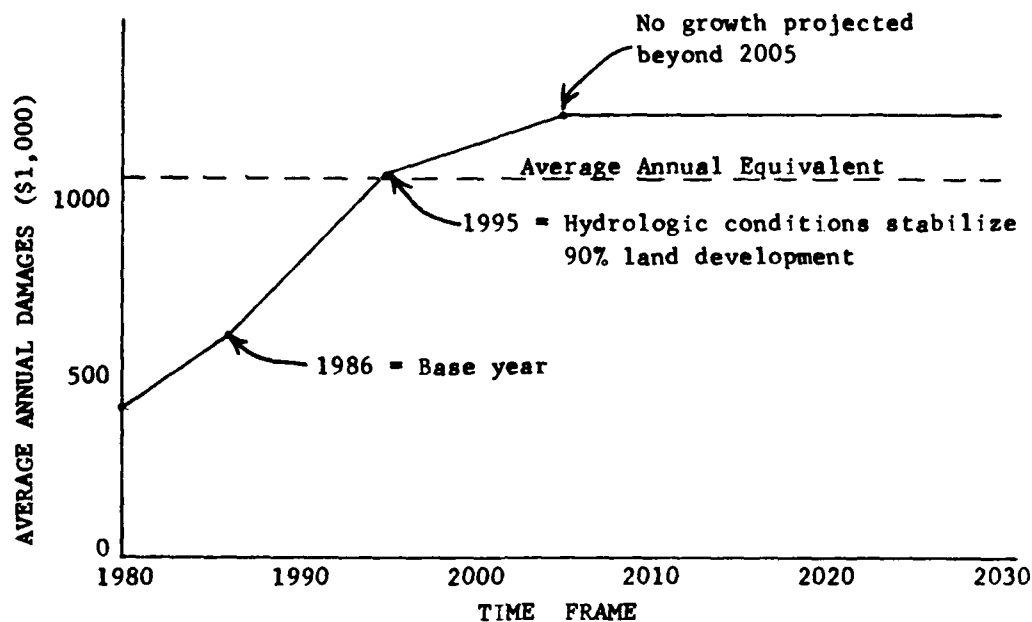


FIGURE 4. Average Annual Flood Damages vs Time

Recreation/Open Space

The City of Fairfield manages 12 parks, ranging in size from 161 acres to one-fourth acre, for a total acreage of 366 acres. Activities served and facilities provided include: soccer/football fields, golf, swimming, playgrounds, tennis courts, basketball courts, and nature and fitness trails. With a 1970 population estimate of 14,700, the demand for activities, such as outdoor games, picnicking, walking/jogging, and bicycling was estimated at 650,000 annual activity days, or 440,000 recreation days (1 rda = 1.5 ada). Based on a 1990 population estimate of 43,000, the demand will increase to 1,900,000 activity days annually, or 1,300,000 recreation days. Although open space and green belt areas are designated on land use plans, no specific facility plans exist at present for meeting the increased needs. Inflation's impact combined with recent high unemployment and pressures on public budgets all lead

to short term low priority for recreation and leisure time facility investments. Realizing opportunities for joint use of remaining open space can aid in maintaining social well being and urban values through multiple resource use and development.

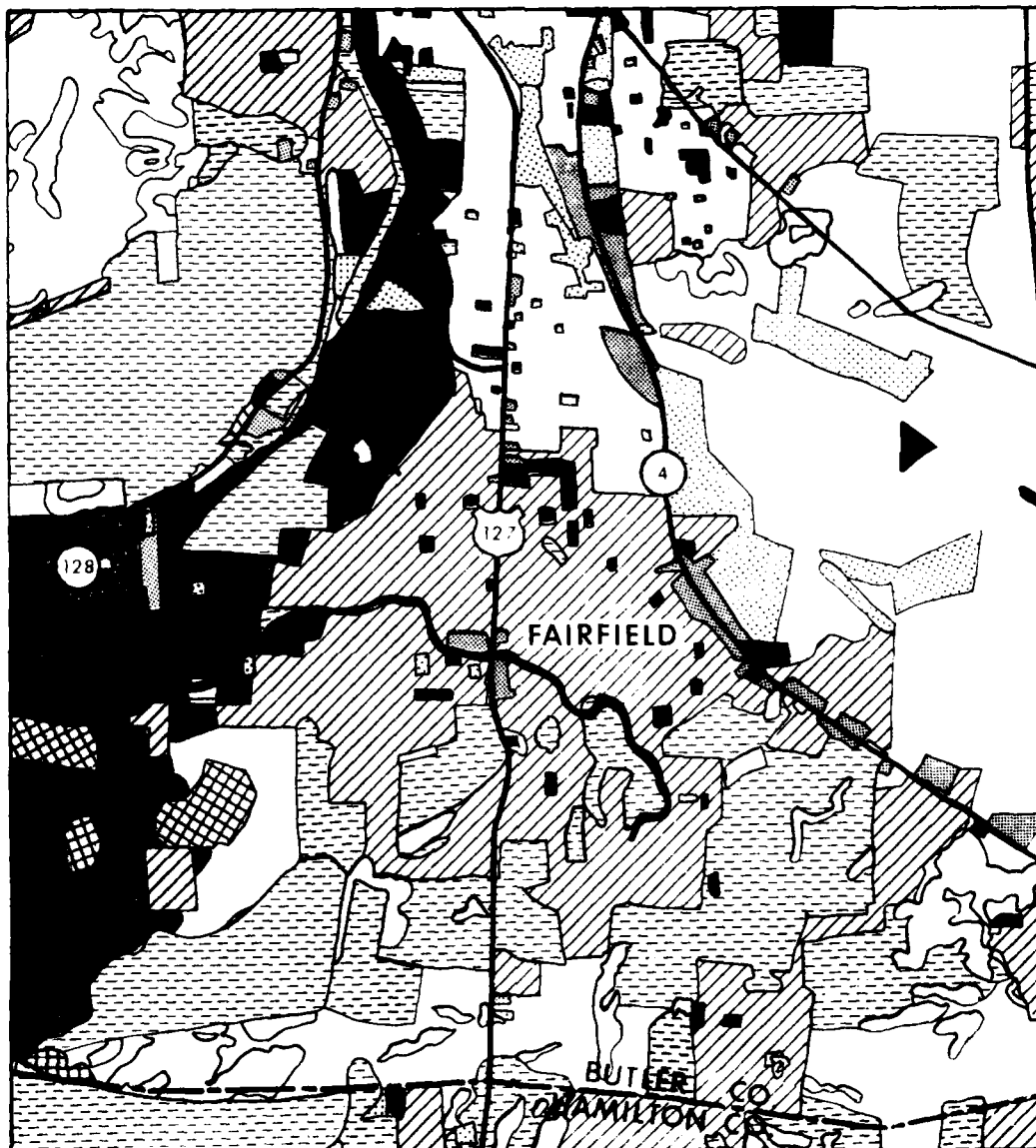
Flood Control Activities

In addition to implementation of flood insurance and flood plain zoning as part of the without project condition, local interests plans for stream maintenance similarly play an important part in the without condition. Under the without project condition, the extent of stream and floodway maintenance to be accomplished is evidenced by: (1) approximately 75 percent of the drainage area's 10.8 miles of stream are protected by easements which prevent construction of permanent structures and permit maintenance access, and (2) debris removal and minor excavation (as detailed in 16 March 1981 Application for Section 404 Permit) will retard deterioration of the stream's carrying capacity. The five year program estimate for item (2) indicates a volume of 4,000 cubic yards per year excavation and the placement of 450 cubic yards per year of gabions or dumped rock for bank stabilization. The extent of work identified will aid in maintaining existing stream conditions: it will not measurably improve current capacity, nor will it meet future runoff needs. The estimated cost for the identified remedial maintenance is \$25,500 per year.

Without project conditions for population, land use, and economic conditions are as indicated under appropriate topic headings in Appendix A. Continued growth will be influenced by the urban growth pressures of Cincinnati and Hamilton metropolitan expansion. Essentially complete development of the Pleasant Run Basin is expected to occur by 1995, thereby contributing to increased runoff of the watershed and increased flood damages to the already urbanized flood plain. The expected changes in land use from 1975 to year 2000 are depicted by Figures 5 and 6.

LEGEND

EXISTING				YEAR 2000	
	URBAN RESIDENTIAL		UTILITIES INDUSTRIAL		RESIDENTIAL
	SUBURBAN RESIDENTIAL		RESOURCE EXTRACTION		NON RESIDENTIAL
	COMMERCIAL		RECREATIONAL OPEN SPACE		
	INSTITUTIONAL SERVICE				



ENVIRONMENTALLY SENSITIVE AREAS

	WATER
	FLOOD PRONE AREAS
	SLOPES

SCALE IN FEET
2500 0 2500 5000 7500

MIAMI RIVER BASIN
FAIRFIELD, OHIO
LOCAL FLOOD PROTECTION PROJECT

LAND USE MAP 2000

PREPARED FROM
OKI (OHIO, KENTUCKY, INDIANA)
REGIONAL LAND USE MAPS

FIGURE 6

PROBLEMS, NEEDS AND OPPORTUNITIES

The purpose of this section is to define and discuss the water resource problems, needs, and opportunities in the study area. Investigations indicate that the major water resource problem is confined to flooding and the need to control drainage from upstream development. As is true in most urbanized areas, there are needs for additional outdoor recreation opportunities and enhancement and preservation of the existing natural environment. Opportunities for solving these needs are intrinsic to measures for alleviating the flood problem.

Water quality in Pleasant Run Creek is generally good with no known point source pollutant discharges. No irrigation problems exist in the study area. However, the area along Banker Drive and Crystal Drive has had past problems of water backing up in storm sewers and water in sanitary sewers backing up in homes.

The development of hydroelectric power would not be practical due to the size of Pleasant Run Creek.

The primary desire of local interests in the study area is relief from flooding. Increased urbanization will result in increased flooding and flood damages. A citizen's group called the "August 1st Alliance" was formed after the 1 August 1979 flood along Pleasant Run Creek. The group, composed primarily of residents along Banker Drive and Crystal Drive, has been actively involved in obtaining relief from flooding. The interest of local officials is expressed in the Exhibits to Appendix C. The scoping activities for this study, as discussed below, defined the views of the public and other agencies.

SCOPING ACTIVITIES

Scoping begins early and is an open process designed to identify both the likely significant issues to be addressed and the range of those issues. It is specifically designed to improve planning, through early and continuing involvement in the planning process, by increasing agency and public involvement.

In accord with Section 1501.7 of the National Environmental Policy Act (NEPA), a notice of intent to prepare an environmental impact statement (EIS) was published in the Federal Register on 30 January 1981, following the receipt of a formal request from local interests to proceed with the study. Input from the public on the scope of problems and opportunities, alternative solutions, and issues and impacts was obtained at meetings held in November 1980 and January 1981. The following efforts included completion of inventories and evaluation of a full range of alternative plans. Numerous local meetings with citizens and public officials have been utilized, including a field trip and tour of the stream and project areas by planners of the Corps of Engineers and U.S. Fish and Wildlife Service and representatives for the local sponsor on 3 March 1981. This scoping process has been utilized to: (1) identify the relevant problems and opportunities; (2) explain and define the level of study and detail for investigations undertaken; (3) identify the full range of alternatives and to screen them to those plans for detailed analysis; and (4) limit evaluation and impact assessments to the relevant and/or required issues. Participation in meetings held throughout the scoping process has provided the necessary input data for definition of other planning efforts related to the current study. The results of scoping activities are presented throughout this report as the planning process and results are documented.

PLANNING CONSTRAINTS

The planning process must consider all constraints in the formulation of alternatives. The 1936 Flood Control Act provides two constraints to the planning process in respect to Federal participation. These constraints require that for any flood control project, the benefits must exceed the costs and that the residual conditions should not adversely affect the lives and security of the people. The latter statement has been interpreted to mean that a high degree of protection is desirable and mandatory if a catastrophe would be likely with a low degree of protection. A more comprehensive interpretation of benefits versus costs results from the Principles and Standards for Water and

Related Land Resource Planning in that the combined beneficial NED and EQ effects must outweigh the combined adverse NED and EQ effects. While specific NED and EQ objectives are defined in the following paragraph, limits of attainment due to additional constraints will surface in the plan formulation and evaluation sections of this report.

NED/EQ DESIRED OUTPUT (OBJECTIVES)

As a result of the inventory of existing problems, opportunities, and water and related land resources of the Pleasant Run study area and following coordination with interested agencies and the affected public, the following objectives can be stated:

NED Desired Output (Objectives)

- Reduce flood losses throughout the Pleasant Run study area to the extent that it is economically and financially feasible
- Through the joint use of area resources, increase the value of and opportunities for urban oriented recreation experiences in the Fairfield and Pleasant Run study area.

EQ Desired Output (Objectives)

- Enhance and preserve the ecological attributes of Pleasant Run and its tributaries
- Enhance and preserve the ecological attributes of wooded and vegetated open areas in the Pleasant Run drainage area
- Reduce the threats to public health and safety within the flood plain and as affected by flooding at Fairfield
- Preserve the aesthetic qualities of neighborhood residential and commercial areas along Pleasant Run

The above NED and EQ objectives and opportunity statements are measured in various units as developed in the following plan formulation section of this report. Beneficial and adverse contribution to the above objectives are further evaluated against the without project condition and planning setting over the period of 1980 to 2036.

FORMULATION OF PRELIMINARY PLANS

The formulation of preliminary plans essentially consists of the first iteration of alternative actions available for resolving problems and addressing resource opportunities. Alternative concepts are introduced, then alternative plans specifically identified. Plans are then evaluated in terms of their completeness, effectiveness, efficiency, and acceptability and in terms of their beneficial and adverse effects on previously established NED and EQ objectives. The result of the analysis of preliminary plans is the identification of candidate plans for detailed study and evaluation. Among these candidate plans will be:

- A plan that reasonably maximizes contributions to NED
- A plan that reasonably maximizes contributions to EQ
- A primarily nonstructural plan
- One or more plans as necessary to identify tradeoffs available among candidate plans

APPLICABLE WATER RESOURCE MANAGEMENT MEASURES

A wide variety of technical and institutional measures exist for managing water and related land resources. Those measures identified at this stage are as follows.

Raise-in-Place

Evacuation (permanent and temporary)

Relocation

Flood Proofing

Flood Warning Systems

Tax Incentives

Building Codes and Zoning

Flood Insurance

Channel Enlargement

Levees and Floodwalls

Floodwater Diversion

Reservoirs (Detention or Dry Bed)

Plan Formulation Rationale

The process of plan formulation and evaluation during this preliminary assessment provides the basis for identifying applicable measures and defining the opportunities for making contributions to previously stated NED and EQ objectives at Fairfield, Ohio and along Pleasant Run. Criteria and tests to be utilized in this evaluation include:

- Completeness--the extent to which a plan provides and accounts for all necessary investments or other actions to ensure the realization of planned effects
- Effectiveness--the extent to which a plan alleviates specified problems and achieves the specified opportunities
- Efficiency--the extent to which a plan is the most cost effective means of alleviating the specified problems and realizing the specified alternatives
- Acceptability--the workability and viability of a plan with respect to acceptance by the public and compatibility with existing laws, regulations, and public policies

ANALYSIS OF PLANS CONSIDERED IN PRELIMINARY PLANNING

A description and evaluation of plans considered during preliminary plan formulation is presented in the following paragraphs.

Raise-in-Place

Subject to depths of flooding and type structures located in the flood plain along Pleasant Run, this alternative considers raising the structures (first floor) above a particular flood level in order to eliminate or reduce the potential for flood damages. Alternative raise-in-place plans investigated included levels of flooding at the 10, 25, and 100-year flood levels, by study reach. Due to physical limitations, based on type of construction, only 86 residential units out of 790 units within the future 100-year flood limit could be raised in place. A summary of the results of application of this alternative to the study area is shown in Table 2. While study Reach PR-6 was the only reach that exhibited economic feasibility (sample data also shown below) residual damages are high because only about 10 percent of the homes in the respective flood plains could physically be raised in place.

TABLE 2
RAISE-IN-PLACE SUMMARY

Area and Flood Level	Total Number of Units	Number of Units Physically Affected	First Costs (\$1,000)	Benefit to Cost Ratio
Total Study Area 100-Year	790	86	2,100	0.10
Reach PR-6 100-Year	83	9	172	1.8
25-Year	71	8	170	1.5
10-Year	55	4	85	1.5

No other stream reach exhibited economic feasibility at any level.

Evacuation

This alternative considers the acquisition of flood prone properties, assisting the residents in finding safe and decent housing, removal of flood prone structures from the flood hazard zone and conversion of lands to uses more compatible with the risk of flooding. Alternative evacuation plans investigated considered levels of flooding at the 10, 25, and 100-year flood levels, throughout the damage reaches along Pleasant Run and its tributaries. A summary of the results are shown in Table 3. For preliminary evaluation and screening purposes, the resulting vacant lands are converted to open space with urban oriented recreation facilities for day use activities.

Of the 19 study reaches (see Plate 1) investigated, Reach PR-6 produced the best results economically, although benefits were well below unity for flood control only and slightly below unity with recreation added.

Relocation

Relocation of flood prone structures considers relocating or moving those structures that can be physically moved. Structures that cannot be physically moved are either raised or elevated, or acquired and dismantled. Some higher costs are involved in improving land outside the flood plain for the relocated units. Remaining vacant lands are then developed for open space and urban oriented outdoor day use type recreation development. A summary of the relocation alternatives is presented in Table 4.

TABLE 3

EVACUATION SUMMARY

Area and Flood Level	Number of Units	First Cost With Recreation (\$1,000)	Annual Benefits With Recreation (\$1,000)	Benefit to Cost Ratio	
				With Recreation	Without Recreation
Study Area					
100-Year	790	61,400	1,460	0.30	0.16
Reach PR-6					
100-Year	83	6,430	460	0.76	0.59
25-Year	71	5,270	430	0.82	0.66
10-Year	55	3,540	380	0.89	0.75

TABLE 4

RELOCATION SUMMARY

Area and Flood Level	Number of Units	First Cost With Recreation (\$1,000)	Annual Benefits With Recreation (\$1,000)	Benefit to Cost Ratio	
				With Recreation	Without Recreation
Study Area					
100-Year	790	72,650	3,000	0.56	0.46
Reach PR-6					
100-Year	83	7,760	490	0.78	0.62
25-Year	71	6,620	450	0.84	0.69
10-Year	55	5,460	400	0.91	0.78

Flood Proofing

This alternative considers preventing water from entering structures at various flood levels by installation of permanent or semipermanent closures and waterproofing measures. This can be accomplished by sealing exterior surfaces and placing aluminum or steel flood shields over openings prior to a flood. Structures with exterior walls of brick, brick veneer, concrete, and cement block can be flood proofed within the subject limits of three to four feet depths of flooding. Of 790 units in the flood plain, 674 were judged to be subject to flood proofing; the remainder were not subject to flood proofing due to type construction or depth of flooding. A summary of the analysis of this alternative is shown in Table 5.

TABLE 5
FLOOD PROOFING SUMMARY

Area and Flood Level	Total Number of Units	Number of Units Physically Affected	First Costs (\$1,000)	Benefit to Cost Ratio
Total Study Area 100-Year	790	674	5,710	0.21
Reach PR-6 100-Year	83	83	1,400	1.8
25-Year	71	71	1,190	1.8
10-Year	55	55	930	1.6

While the above analysis and support data show no potential for this alternative as a singular solution for overall application at Fairfield, opportunities may exist to utilize flood proofing in combination with other measures.

Construction of Small Walls and/or Levees

Individual walls and/or levees were not considered feasible nor viable because of the large number of residential units.

Relocation of Damageable Property Within Existing Structure

Preliminary evaluation of space requirements for relocating facilities such as furnaces, water heaters, and laundry facilities, found that few, if any, houses could accommodate such a relocation without added space. No further consideration was given to this alternative.

Floodwalls and Levees

Because of the limited areas available for construction, floodwalls and levees were given limited consideration. A plan was briefly reviewed which would provide flood protection for a 500-year flood for the Crystal Drive-Banker Drive area in Reach PR-6 and for limited protection along other areas of Pleasant Run Creek. Major channel enlargement or additional levees were required to prevent induced flood damages that would result. Further consideration was not given to floodwalls or levees.

Floodwater Diversion

A review of the Pleasant Run watershed and potential receiving streams concluded that there were no practical alternatives for diverting flood flows. No further consideration was given to this alternative.

Channel Enlargement

Channel enlargement involves widening and straightening the channel in order to improve the hydraulic carrying capacity of the stream. Typically, channelization requires the construction of a trapezoidal channel, removal of vegetation, obstacles, and irregularities. The

effect on terrestrial and aquatic wildlife can be severe and result in long term recovery.

Channel enlargement, as a measure to reduce or eliminate flood damages throughout the study area, was initially investigated throughout all the study reaches previously identified (see Plate 2). Initial investigations considered: (1) varying types of construction such as earth channel, gabion, concrete, and requirements for riprap at various earth sections as well as (2) review of various increments in the length of stream to be provided protection; and (3) varying levels of protection.

Study reaches were eliminated in tributary areas due to inefficiency and lack of cost effectiveness to the extent of channel enlargement that would result in economic feasibility. At initial construction costs of about \$9.8 through \$10.3 million, the range of improvement from a 25-year channel to a 35-year channel shows sufficient economic feasibility to warrant further consideration. Channel improvement remained economically feasible when considering work only in Reaches PR-2 through PR-6. The addition or extension of the next study reach, in each case, dropped the overall project into the infeasible range.

Although various levels of channel enlargement exhibit economic feasibility and contribute significantly toward flood damage reduction, significant adverse environmental effects occur through disruption of the aquatic community and elimination of streambank habitat. Depending on the degree of protection, the resulting backyard depth losses vary from 20 to 50 feet. In the downstream study reaches--PR-2 and PR-3--such losses would reduce remaining backyard depths to 20 or 30 feet. These social, environmental, and aesthetic adverse impacts contribute to the general community's lack of endorsement for extensive channel enlargement.

Channel enlargement alternatives include environmental engineering design features such as the construction of pools and riffles, low flow channels, channel construction activities restricted to one side of the

channel only (where possible), and mitigation of habitat losses through acquisition of five acres of adjacent wooded area in Reach PR-6. Summary data on channel enlargement alternatives are presented in Table 6. While channel enlargement alternatives exhibit marginal economic feasibility and would result in significant reductions in average annual damages, these alternatives offer little opportunity for contributing to environmental needs and objectives. Some 2.92 miles of stream aquatic environment would be impacted in the short term due to construction activities and a similar amount of streambank vegetation cover would be permanently altered or removed. Because of shallow backyards in the lower stream reaches and the channel widths required for construction activities and right-of-way, this alternative has further adverse social and aesthetic impacts that are undesirable to residents.

Dry Bed Reservoirs

Dry bed reservoirs, also called retarding or detention structures, were investigated at several locations in the drainage basin. Initially, five sites were considered in the drainage area upstream of Reach PR-6. As a result of review of the storage area available and facility and property relocation requirements, five sites were screened to the four as shown on Plate 3. Apartment buildings and road relocations were the primary factors impacting on screening of potential reservoir sites to four.

Physical data on the four reservoir sites are presented in Table 7.

TABLE 6
DATA SUMMARY
CHANNEL ENLARGEMENT ALTERNATIVES

Level of Protection 1/	Channel Design Flow (cfs)	Bottom Width (feet)	Right-of-way Required 3/ (acres)	Initial Construction Cost (\$1,000)	Net Benefits (\$1,000)	Benefit to Cost Ratio	Percent AAD 2/ Reduction
10-Year	7,000	60-155	98	8,200	-37	0.95	64
25-Year	8,600	65-190	118	9,800	+22	1.02	82
35-Year	9,200	65-195	129	10,300	+23	1.02	82
100-Year	11,200	80-200	148	12,100	-141	0.87	83
Standard Project Flood	16,600	95-280	202	17,500	-594	0.63	85

1/ All plans require channel depths from 9 to 154.5 feet, replacement of East River Road, Pleasant Avenue, and Nilles Road bridges, and extend from Mile 0.6 through 3.52 on Pleasant Run Creek.

2/ AAD - Average Annual Damages

3/ Includes land for channel and land for disposal areas

TABLE 7
ALTERNATIVE RESERVOIR SITES

Site No.	Location	Height of Dam (Feet)	Storage Volume (Acre-Feet)	Ponding Elevation (Feet NGVD)	Acres Required 1/
A	High School Tributary	37	150	658.8	31
C	East Fork	47	578	665.9	64
D	Pleasant Run	44	510	695.5	45
E	Pleasant Run Tributary	40	98.5	706.4	33

1/ Includes borrow area and ponding area.

The individual reservoir sites were designed considering efficient use of the sites, prevention of frequent spillway utilization, and efficient use of storage areas. Good utilization of the physical sites resulted in spillway crests being established a foot or so above the 500-year, 2-hour, storm duration pool level, which prevents frequent utilization of the spillways. Still the storage capacities of the reservoirs are not so large (A--3.0 inches; C--3.4 inches; and D--3.3 inches) to prevent fairly frequent use of the pool areas. Pool elevations for various frequency floods are shown on Plates D-60, D-61, and D-62 of Appendix D. With these reservoirs in place, all potential floods would be reduced to a degree, but flooding would still occur in downstream reaches due to uncontrolled tributaries and mainstem drainage. For these reasons channel improvement was considered for reaches having residual damages in order to provide an equitable and acceptable level of protection for the damage reaches. Combinations of dry bed reservoirs and channel enlargement were evaluated at the 35, 100, and SPF levels of protection. While individual reservoir sizing was not undertaken, the extent of channel enlargement was varied for the levels of protection desired and as required when individual reservoirs were excluded or included.

The range of reservoir and channel enlargement plans investigated is shown in Figure 7. The analysis in Figure 7 shows that significant improvement in contributions to NED can result by integration of dry bed reservoirs with channel enlargement to obtain given levels of protection. The impact is most significant at the 35-year level of protection where three reservoir sites--A, C, and D--are combined with approximately 0.83 mile of channel enlargement in Reach PR-6. The net benefit contribution by this plan over other plans is due to a combination of: (1) increased flood damage reduction in those stream reaches between the reservoir sites and the upstream end of improvement for the all channel plans; (2) plus critical reductions in relocations and channel construction costs in a sensitive range of channel enlargements.

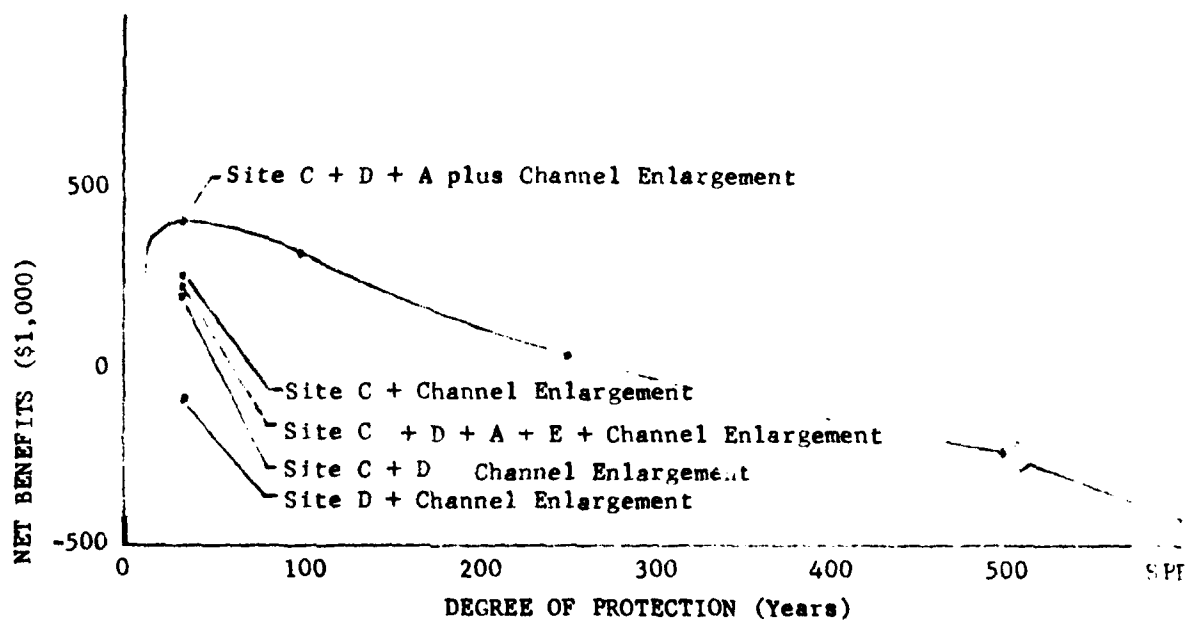


FIGURE 7. Reservoir Scoping

Summary data for the actual plans investigated in preliminary screening are shown in Table 8. This level of screening shows that opportunities exist to provide significant reductions in average annual flood damages (90%+) with the use of reservoirs and channel enlargement. Also significant is that while required right-of-way acreage shown under channel enlargement plans generally represented acres subject to adverse environmental impacts, acreages shown under the dry bed reservoir combination plans contain significant opportunities to preserve open space and basin vegetative cover. Further evaluation of these contributions will be made in detailed plan evaluation. The combination of dry bed reservoirs plus channel enlargement offers

TABLE 8

DATA SUMMARY
 DRY BED RESERVOIRS PLUS CHANNEL ENLARGEMENT ALTERNATIVES

Level of Protection	Plan Definition	Right-of-Way Required 1/ (Acres)	Initial Construction Cost (\$1,000)	Net Benefits (\$1,000)	Benefit to Cost Ratio	Percent AAD Reduction
35	Site D plus 2.92 mile channel; replace East River Road, Pleasant Avenue, and Nilles Road bridges	173	13,200	-94	0.92	87
35	Site C plus 2.92 mile channel	192	9,900	+282	1.3	91
35	Sites D + C plus 2.56 mile channel; replace East River Road and Nilles Road bridges	177	12,009	+209	1.2	96
35	Sites D + C + A plus 0.83 mile channel; no bridge replacements	162	10,300	+430	1.5	97
35	Sites D + C + A + E plus 0.83 mile channel; no bridge replacements	196	12,700	+259	1.2	98

TABLE 8 (Continued)

Level of Protection	Plan Definition	Right-of-Way Required 1/ (Acres)	Initial		Net Benefits (\$1,000)	Benefit to Cost Ratio	Percent AAD Reduction
			Construction Cost (\$1,000)	Cost (\$1,000)			
100	Site C plus 2.92 mile channel	207	11,700		+144	1.15	92
100	Sites D + C plus 2.56 mile channel; replace East River Road and Nilles Road bridges	193	12,900		+127	1.12	97
100	Sites D + C + A plus 1.37 mile channel; replace East River Road bridge	174	11,900		+304	1.3	97
SPF	Sites D + C + A plus 2.92 mile channel; replace three bridges	286	20,800		-440	0.76	99.8

significant opportunity to provide positive contributions to NED and provide for significant reductions in the adverse effects of flooding on public health and safety. Significant opportunities also exist for these plans to provide contribution to the environmental objective through prevention of development on lands required for dam construction, ponding areas and borrow areas. Depending on project use, i.e. dam, borrow, or ponding areas, significant and minor contributions result to preservation of open space and upland vegetation and wildlife habitat. These minor and significant environmental contributions come in trade for less of the adverse impacts resulting from channel enlargement, depending on the reservoir alternative considered.

Additional Combination Plans

Since nonstructural measures were found to be economically infeasible for all concepts considered and at all levels of protection considered, an all nonstructural plan could not be developed that met minimum requirements for implementability. Combining nonstructural measures (all plans infeasible) with channel enlargement (plans marginally feasible) would offer limited opportunity to provide contribution to NED or EQ objectives. However, nonstructural measures (which contribute to EQ objectives) combined with the dry bed reservoir concept (which has positive NED and EQ impacts) offers opportunity to provide a plan with major nonstructural features and a total plan contribution to NED and EQ objectives.

The three dry bed reservoir sites (A, C, and D) were combined with flood proofing, evacuation and relocation to develop a plan with major nonstructural features. With the design level of protection at 100 years, the residual 100-year future flood condition (as modified by dry bed reservoirs A, C, and D) was established. In order of cost effectiveness, residual units within the modified future 100-year flood limits were then flood proofed (29 units for all units physically subject to flood proofing) with residual units evacuated (35 units) and relocated (14 units). Areas vacant as a result of evacuation and relocation were converted to open space and recreation use.

Total cost of nonstructural flood control measures is \$7,963,000 added to the reservoir sites A, C, and D (\$8,680,000) equals \$16,643,000. With annual costs of the flood control measures at \$1,450,000 and annual benefits of \$1,491,000, the flood control benefit to cost ratio is 1.3. Additional recreation facilities at the structural components (dry bed reservoirs) result in a total first cost of \$17,740,000. With annual costs of \$1,637,000 and annual benefits of \$1,950,000, the benefit to cost ratio is 1.2.

Contributions to NED and EQ combined provide net positive impacts as a result of evacuation and relocation; community cohesion would be adversely affected.

COMPARATIVE ASSESSMENT AND EVALUATION OF PRELIMINARY PLANS

The previous discussion presented a brief review of the range and scoping of alternatives which provide varying levels of opportunities to fulfill the planning objectives and realize resource opportunities. Some alternative concepts clearly contribute to NED or EQ objectives but not both. Other alternative concepts exhibit significant potential to contribute to both NED and EQ objectives and realize resource opportunities of the basin and study area.

The major objectives and evaluation criteria, as become evident during the public involvement activities of the study, are utilized for screening of preliminary plans. Identification of these criteria and plan concepts which best meet these criteria are provided at this point as the step previous to selection of plans for detailed study. See Table 9.

TABLE 0

MAJOR OBJECTIVES

Objective/Opportunity/Criteria	Measure	Plan Concept
<u>NED Desired Output</u>		
Reduce flood losses	Percent AAD reduction	Reservoirs and channel nonstructural at 100-year and SPF
Net contributions to NED	Net benefits	Reservoirs and channel at 35-year
Increase recreation opportunities	Annual recreation days provided	Reservoirs and channel or nonstructural
<u>EQ Desired Output</u>		
Preserve and enhance ecology of stream	Stream miles and acres affected	Reservoirs and nonstructural
Preserve and enhance ecology of basin	Quality and quantity of acres	Reservoirs and nonstructural
Reduce threat to public health and safety	Degree of protection 35-year minimum	Reservoirs and channel
Preserve aesthetic quality of neighborhoods	Project impacts relocations	Reservoirs and channel
Equitable distribution of adverse and beneficial effects	Broad distribution of impacts	Reservoirs and channel

Application of the four tests to preliminary plan concepts considered is as follows:

Completeness: Level of analysis is considered equal for concepts considered. Test not considered appropriate at this stage.

Effectiveness: Clearly, reservoirs with channel enlargement or nonstructural components offer the best opportunities for alleviating flood problems and achieving recreation, open space, and environmental opportunities.

Efficiency: Opportunities for joint use of project lands in achieving recreation and open space needs are significant with reservoirs and considered more efficient than other single purpose uses of the area's land resources. Data developed thus far show reservoirs to be cost effective in reducing flood damages.

Acceptability: In order of acceptability, the plans or plan concepts most acceptable to the public are:
(1) reservoirs with channel enlargement,
(2) channel enlargement only, and (3) reservoirs with flood proofing, relocation and evacuation.

CANDIDATE PLANS FOR DETAILED EVALUATION

With the above standards defined, candidate plans selected for detailed study are as follows:

Candidate NED Plan

The 35-year degree of protection, three dry bed reservoir plan with 0.83 mile of channel enlargement is tentatively selected as the candidate NED plan primarily based on its potential to provide maximum

contributions to NED (maximum net benefits). The plan ranks high in potential to achieve recreation and environmental opportunities and to meet environmental objectives. While generally publicly acceptable, the plan, at the 35-year degree of protection is marginal in meeting public health and safety objectives. All plans at less than a 35-year degree of protection were judged to not meet objectives and opportunities and therefore were not candidates for further detailed study. The only other plan that provides comparable NED and environmental attributes, with resolution of the low degree of protection problem is the 100-year degree of protection, three dry bed reservoir plan with 1.37 miles of channel enlargement. This plan reflects tradeoffs between NED and EQ objectives and is also retained for detailed study.

Nonstructural Plan

Although an all nonstructural plan could not be formulated that provided net contributions to the NED and EQ objectives, the combined NED and EQ effects of the 100-year, three dry bed reservoir plan plus nonstructural measures substantially meets the evaluation criteria. The plan includes major nonstructural components and is, therefore, retained for detailed study as the primarily nonstructured plan.

Candidate EQ Plan

Through the combined output of the 100-year, three dry bed reservoirs and nonstructural components of the "Nonstructural Plan," in terms of enhanced and preserved stream environment and basin open space and vegetation, the "Nonstructural Plan" is tentatively designated the candidate EQ plan and, therefore, retained for further detailed study.

Tradeoff Plan

The above plans all involve some combination of dry bed reservoirs. Realization of potential NED and EQ outputs and opportunities of the reservoir plans requires early action by local interests to preserve reservoir sites. In the absence of their early action, channel enlargement remains as the only potentially viable structural solution to flood

problems at Fairfield. For this reason, a channel enlargement alternative is also retained for detailed evaluation. While both the 35-year and 100-year degree of protection plans exhibit limited capability to provide urban oriented outdoor recreation opportunities, they represent options in the event that reservoir sites cannot be reserved. The 35-year, 2.92 mile channel enlargement alternative is retained for detailed evaluation due to its economic feasibility.

ASSESSMENT AND EVALUATION OF DETAILED PLANS

The previous section identified the plans warranting detailed studies. This section will furnish the detailed description, impact assessment, and evaluation for each of the four plans studied in detail. For clarity during further discussion of these plans, the following designations are assigned.

Plan H-- NED Plan. 35-year, 3 dry bed reservoirs plus 0.83 mile of channel enlargement with recreation.

Plan J-- A Tradeoff Plan. 100-year, 3 dry bed reservoirs plus 1.37 miles of channel enlargement with recreation.

Plan I-- Nonstructural/EQ Plan. 100-year, 3 dry bed reservoirs plus flood proofing, relocation and evacuation with recreation.

Plan K-- A Tradeoff Plan. 35-year all channel plan with recreation.

Plan descriptions, impact assessments, evaluation and tradeoff analysis conducted for each plan will be oriented toward confirmation of the designation of the NED, nonstructural, and EQ plans. Table 10 presents an impact assessment summary for the detailed plans and Table 11 presents an evaluation summary of the detailed plans. Table 12 presents a summary of comparison of these detailed plans.

TABLE 1
IMPACT ASSESSMENT SUMMARY OF DRAINAGE PLANS

Impact and Evaluation Factors	Most Probable Future "Without Conditions"	Plan R		Plan S		30-Year Channel Enlargement
		30-Year-3 Reservoirs plus Channel Enlargement	97 percent	100-Year-3 Reservoirs plus Channel Enlargement	99 percent	30-Year Channel Enlargement
Planning Objectives (Reduction in Flood Damage)	AAD - \$433,000 in 1980; increased to \$1,242,000 by 2005. Total AAD = \$1,074,000	\$10,340	\$11,900	\$16,600	\$10,700	81 percent
IMPACT ASSESSMENT						
National Economic Development						
Project First Cost Z' (\$1,000)	---	1,420	8,270	12,450	4,100	---
Federal	---	2,920	4,130	4,130	4,100	---
Project Annual Cost Z' (\$1,000)	---	909	1,056	1,439	931	---
Residual AAD (\$1,000)	---	37	31	16	19	---
Benefits AAD (\$1,000)	---	1,346	1,366	1,481	899	---
Benefit-Cost Ratio	---	1.5	1.3	1.03	1.02	---
Net Benefits (\$1,000)	---	437	310	52	25	---
Environmental Quality						
Terrestrial Habitat	Stream canopy remains; songbird and small mammal habitat is preserved; riparian habitat will be converted to residential development except for 7 acres at C and 3 acres at Site D	Alters about 0.3 mile of streambank; preservation of streambank habitat; destruction of about 0.3 mile of streambank habitat and enhancement about 1.0 mile of streambank habitat	Alters about 1.37 miles of streambank; preservation of about 0.7 mile of streambank habitat; base streambank impacts as 35-year plan	Preservation of about 0.3 miles of streambank habitat; destruction of about 0.3 mile of streambank habitat and enhancement about 1.0 mile of streambank habitat	Alters about 2.47 miles of streambank; temporarily disrupts all streambank habitat; preservation of about 1.0 mile of streambank habitat	---
Aquatic Habitat	Shallow pools and riffles support stable community of fishes	Destructs 0.3 mile of stream habitat; alteration of 1.37 miles of streambank habitat; preservation of about 1.0 mile of stream	Destructs 0.3 mile of stream habitat; alteration of 1.37 miles of streambank habitat; preservation of about 1.0 mile of stream	Destructs 0.3 mile of stream habitat; alteration of 1.37 miles of streambank habitat; preservation of about 1.0 mile of stream	Alteration of 2.47 miles of stream	---
Soils and Erosion	899 in 100-year flood plain; 1,014 in 500-year flood plain	772 units relative 100-year level of protection	788 units relative 100-year degree of protection	About 120 houses are feared to be level; level is estimated and re-estimated with	About 600 units relative 100-year degree of protection	---
Properties Affected (Properties under Plans and Degree of Protection)	As flooding increases in future years, neighborhoods may deteriorate and residents may move - depends on severity of flooding	Although 12 adjacent units are taken, flood reduction should enhance community cohesion	Although 12 adjacent units are taken, flood reduction should enhance community cohesion	Although 12 adjacent units are taken, flood reduction should enhance community cohesion	Reduced flooding would enhance community cohesion	---
Health and Safety	Transportation, water, and utility services will be interrupted, outages, etc.	SPWETS COMPENSATORY WITH	SPWETS	SPWETS	---	---
Regulation, Law, and Policy	State of flood insurance, flood insurance, flood insurance, flood insurance	State of flood insurance, flood insurance, flood insurance, flood insurance	State of flood insurance, flood insurance, flood insurance, flood insurance	State of flood insurance, flood insurance, flood insurance, flood insurance	State of flood insurance, flood insurance, flood insurance, flood insurance	---

45

DATE	TIME	LOCATION	TYPE	DESCRIPTION	STATUS	REMARKS
10/10/54	10:00	1000	1	Water in cell subject to flood water 1 1/2	None	Area is 11 feet high to top of ground floor flood water 1 1/2
10/10/54	10:00	1000	2	Water in cell subject to flood water 1 1/2	None	Water in cell subject to flood water 1 1/2
10/10/54	10:00	1000	3	Water in cell subject to flood water 1 1/2	None	Water in cell subject to flood water 1 1/2
10/10/54	10:00	1000	4	Water in cell subject to flood water 1 1/2	None	Water in cell subject to flood water 1 1/2
10/10/54	10:00	1000	5	Water in cell subject to flood water 1 1/2	None	Water in cell subject to flood water 1 1/2
10/10/54	10:00	1000	6	Water in cell subject to flood water 1 1/2	None	Water in cell subject to flood water 1 1/2
10/10/54	10:00	1000	7	Water in cell subject to flood water 1 1/2	None	Water in cell subject to flood water 1 1/2
10/10/54	10:00	1000	8	Water in cell subject to flood water 1 1/2	None	Water in cell subject to flood water 1 1/2
10/10/54	10:00	1000	9	Water in cell subject to flood water 1 1/2	None	Water in cell subject to flood water 1 1/2
10/10/54	10:00	1000	10	Water in cell subject to flood water 1 1/2	None	Water in cell subject to flood water 1 1/2

[illegible][illegible]

1. The first part of the report is a general introduction to the subject of the study. It discusses the importance of the study and the objectives of the research. It also provides a brief overview of the methodology used in the study.

[illegible]

TABLE 12

SUMMARY OF COMPARISON OF DETAILED PLANS

OF DETAILED PLANS									
Plan Description	Base Condition	Without Condition	Plan H 1/ 35-Year - 3 Reservoirs plus Channel Enlargement		Plan J 1/ 100-Year - 3 Reservoirs plus Channel Enlargement		Plan K 1/ 35-Year Channel Enlargement		
			1980 Condition	1980 Condition	1980 Condition	1980 Condition	1980 Condition	1980 Condition	
Account Factors									
economic									
First Cost	---	---	\$10,340,000	\$11,900,000	\$16,600,000	\$10,300,000			
Annual Cost	---	---	909,000	1,056,000	1,439,000	933,000			
Flood Control Benefits	None	---	1,346,000	1,366,000	1,491,000	958,000			
Residual Flood Damages	Damages will continue to occur at an AAR rate of \$1,076,000	---	\$ 37,000	\$ 31,000	\$ 16,000	\$ 190,000			
Benefit-Cost Ratio	Not applicable	Not applicable	1.5	1.3	1.03	1.02			
Net Benefits	Not applicable	Not applicable	\$ 437,000	\$ 310,000	\$ 57,000	\$ 25,000			
Planning Objectives	Not applicable	Not applicable	Reduces flood damages in study area by 97 percent and degree of protection is low	Reduces flood damages in study area by 97 percent and degree of protection is adequate	Reduces flood damages in study area by 99 percent and degree of protection is adequate	Reduces flood damages in study area by 82 percent and degree of protection is low			
Environmental									
Noise, Air and Water Quality	No effect	Insignificant	Short term adverse impact on noise, air, and water quality	Short term adverse impact on noise, air, and water quality	Short term adverse impact on noise, air, and water quality	Short term adverse impact on noise, air, and water quality			
Ecological Systems	No effect	Adverse impacts due to some relocation of homes and essential complete development of watershed	Adverse impact on aquatic habitat and streambank habitat for about 1.1 miles	Adverse impact on aquatic habitat and streambank habitat for about 1.7 miles	Adverse impact on aquatic habitat and streambank habitat for about 0.3 miles	Adverse impact on aquatic habitat for about 2.9 miles			
Preservation	No effect	Floodway subject to alteration in degree of preservation	Reservoir and channel areas preserved in altered state about 101 acres; and the preservation of about 67 acres of habitat	Reservoir and channel areas preserved in altered state about 109.5 acres; and the preservation of about 47 acres of wildlife habitat	Preservation of about 42 acres of natural areas; 88 acres of altered areas	Channels are preserved in altered state about 69 acres about 5 acres of woodland preserved			

TABLE 12 (Continued)

	Base Condition	Without Condition	Plan H 1/ 35-Year - 3 Reservoirs plus Channel Enlargement		Plan J 1/ 100-Year - 3 Reservoirs plus Channel Enlargement		Plan I 1/ 100-Year - 3 Reservoirs plus Nonstructural		Plan K 1/ 35-Year Channel Enlargement				
			Stable	Potential disruption due to relocation	Cohesion would be enhanced by protection	"Manicured" channel for 0.83 mile replaces natural stream, and improved condition in reservoir area	Major reduction to flood problems, but infrequent flood problems will remain	Overall enhanced, but some disruption due to relocation	Minor effects on residential areas, and improved condition in reservoir areas	Flood related problems will be reduced, but infrequent flood problems will remain	Cohesion would be enhanced by protection	"Manicured" channel replaces natural stream for about 2.9 miles	Major reduction to flood problems, but infrequent problems will remain
Social													
Community Cohesion	Stable	Potential disruption due to relocation	Minor adverse after flooding	Flood related problems will be reduced, but con- siderable flood problems to remain	20 construction jobs for 1-1/2 years	Positive impact, not quantified	23 construction jobs for 1-1/2 years	Positive impact not quantified	27 construction jobs for 1-1/2 years	22 construction jobs for 1-1/2 years	Positive impact, not quantified	Opposition by locals	The certainty of the impacts is generally 90 percent or better
Aesthetics	Minor adverse after flooding	Flood related problems will continue	None	Continued flood damages	20 construction jobs for 1-1/2 years	Positive impact, not quantified	23 construction jobs for 1-1/2 years	Positive impact not quantified	27 construction jobs for 1-1/2 years	22 construction jobs for 1-1/2 years	Positive impact, not quantified	Opposition by locals	The certainty of the impacts is generally 90 percent or better
Health, Safety and Well Being	Minor adverse after flooding	Flood related problems will continue	None	Continued flood damages	20 construction jobs for 1-1/2 years	Positive impact, not quantified	23 construction jobs for 1-1/2 years	Positive impact not quantified	27 construction jobs for 1-1/2 years	22 construction jobs for 1-1/2 years	Positive impact, not quantified	Opposition by locals	The certainty of the impacts is generally 90 percent or better
Regional Development													
Employment	None	Insignificant	Continued flood damages	Continued flood damages	20 construction jobs for 1-1/2 years	Positive impact, not quantified	23 construction jobs for 1-1/2 years	Positive impact not quantified	27 construction jobs for 1-1/2 years	22 construction jobs for 1-1/2 years	Positive impact, not quantified	Opposition by locals	The certainty of the impacts is generally 90 percent or better
Cost	Continued flood damages	Positive as flood insurance premiums less than flood damages	Continued flood damages	Continued flood damages	20 construction jobs for 1-1/2 years	Positive impact, not quantified	23 construction jobs for 1-1/2 years	Positive impact not quantified	27 construction jobs for 1-1/2 years	22 construction jobs for 1-1/2 years	Positive impact, not quantified	Opposition by locals	The certainty of the impacts is generally 90 percent or better
Response to Criteria													
Acceptability	Continued flood damages	Positive as flood insurance premiums less than flood damages	Continued flood damages	Continued flood damages	20 construction jobs for 1-1/2 years	Positive impact, not quantified	23 construction jobs for 1-1/2 years	Positive impact not quantified	27 construction jobs for 1-1/2 years	22 construction jobs for 1-1/2 years	Positive impact, not quantified	Opposition by locals	The certainty of the impacts is generally 90 percent or better
Certainty	Continued flood damages	Positive as flood insurance premiums less than flood damages	Continued flood damages	Continued flood damages	20 construction jobs for 1-1/2 years	Positive impact, not quantified	23 construction jobs for 1-1/2 years	Positive impact not quantified	27 construction jobs for 1-1/2 years	22 construction jobs for 1-1/2 years	Positive impact, not quantified	Opposition by locals	The certainty of the impacts is generally 90 percent or better
Completeness	Continued flood damages	Positive as flood insurance premiums less than flood damages	Continued flood damages	Continued flood damages	20 construction jobs for 1-1/2 years	Positive impact, not quantified	23 construction jobs for 1-1/2 years	Positive impact not quantified	27 construction jobs for 1-1/2 years	22 construction jobs for 1-1/2 years	Positive impact, not quantified	Opposition by locals	The certainty of the impacts is generally 90 percent or better
Effectiveness	Continued flood damages	Positive as flood insurance premiums less than flood damages	Continued flood damages	Continued flood damages	20 construction jobs for 1-1/2 years	Positive impact, not quantified	23 construction jobs for 1-1/2 years	Positive impact not quantified	27 construction jobs for 1-1/2 years	22 construction jobs for 1-1/2 years	Positive impact, not quantified	Opposition by locals	The certainty of the impacts is generally 90 percent or better
Efficiency	Continued flood damages	Positive as flood insurance premiums less than flood damages	Continued flood damages	Continued flood damages	20 construction jobs for 1-1/2 years	Positive impact, not quantified	23 construction jobs for 1-1/2 years	Positive impact not quantified	27 construction jobs for 1-1/2 years	22 construction jobs for 1-1/2 years	Positive impact, not quantified	Opposition by locals	The certainty of the impacts is generally 90 percent or better
Reversibility	Continued flood damages	Positive as flood insurance premiums less than flood damages	Continued flood damages	Continued flood damages	20 construction jobs for 1-1/2 years	Positive impact, not quantified	23 construction jobs for 1-1/2 years	Positive impact not quantified	27 construction jobs for 1-1/2 years	22 construction jobs for 1-1/2 years	Positive impact, not quantified	Opposition by locals	The certainty of the impacts is generally 90 percent or better
Stability	Continued flood damages	Positive as flood insurance premiums less than flood damages	Continued flood damages	Continued flood damages	20 construction jobs for 1-1/2 years	Positive impact, not quantified	23 construction jobs for 1-1/2 years	Positive impact not quantified	27 construction jobs for 1-1/2 years	22 construction jobs for 1-1/2 years	Positive impact, not quantified	Opposition by locals	The certainty of the impacts is generally 90 percent or better

TABLE 12 (Continued)

	Base Condition	Without Condition	Plan H 1/ 35-Year - 3 Reservoirs plus Channel Enlargement		Plan J 1/ 100-Year - 3 Reservoirs plus Channel Enlargement		Plan I 1/ 100-Year - 3 Reservoirs plus Nonstructural		Plan K 1/ 35-Year Channel Enlargement	
<u>Rankings of Plan Contributions 2/</u>										
Net Benefits		5	1	2	3	4				
Flood Damage Reduction		5	3	2	1	4				
Ecological Systems		4	2	3	1	5				
Preservation		5	2	1	3	4				
Community Cohesion		5	3	2	4	1				
Health, Safety and Well Being		5	2	1	3	4				
<u>Implementation Responsibility</u>										
	Local government agencies	Corps of Engineers and local government agencies	Corps of Engineers and local government agencies	Corps of Engineers and local government agencies	Corps of Engineers and local government agencies	Corps of Engineers and local government agencies	Corps of Engineers and local government agencies	Corps of Engineers and local government agencies	Corps of Engineers and local government agencies	Corps of Engineers and local government agencies

1/ Recreation not included in evaluation and selection of best flood control plan.

2/ Low numbers are desirable

PLAN H (NED)

Plan Description

The NED plan, so designated because it maximizes net contributions to the NED objectives, is the 35-year, three dry bed reservoir plan with 0.83 mile of channel enlargement. Recreation is included as a project purpose in order to realize project and basin resource opportunities. Plan H involves construction of three dry bed reservoirs at locations on High School Tributary, Pleasant Run, and East Fork of Pleasant Run. The dams are earth fill with ogee spillways and uncontrolled conduits. Channel enlargement between Nilles Road and confluence of East Fork varies from 30 to 60 feet and includes concrete and riprap sections. No bridge replacements or modifications are required for the plan, varving from fee acquisition to easements, totals about 162 acres and includes lands necessary for channel construction, spoil disposal, dam construction, ponding, and borrow easements as required to maintain the channel capacity and assure access for operation and maintenance of the project.

Recreation facility development is included on project lands at the dry bed reservoir sites to provide urban oriented, outdoor, day use, recreation opportunities. Concepts vary at each site from (1) limited development for preservation of wooded areas and the provision of facilities for education and interpretive environmental experiences (Site A), to (2) moderate development for general purpose play and game fields and hiking trails (Site D), to (3) intensive development for play fields, hiking and jogging trails, and picnic areas (Site C).

Impact Assessment

Plan H output substantially eliminates flood damages from out of bank flows up to a 35-year frequency flood event (under future runoff conditions) and would reduce the potential damage from larger floods. Average annual flood damages are reduced by 97 percent while damages from an occurrence of the Standard Project Flood (SPF), with Plan H in operation, would be reduced 50 percent. The net contribution to NED by the flood control elements of Plan H are \$430,000 annually.

Additional net contributions to NED by Plan H's recreation features total \$272,000 annually by creating opportunities for 255,000 annual recreation days of urban oriented outdoor recreation.

Channel enlargement throughout 0.83 mile of the basin's 10.8 miles of stream will result in removal of streambank vegetative cover (primarily limited to one side) and will degrade the existing aquatic environment during construction. Provision of pool and riffle complexes and a low flow channel in this section will reduce construction impacts to the extent possible.

Impacts of the project on the basin's open space and terrestrial areas require the following classification and accounting of required project acreages.

	<u>Acres</u>			<u>Total</u>
	<u>Dam</u>	<u>Borrow</u>	<u>Ponding</u>	
Site A	11	10	10	31
Site C	21	23	20	64
Site D	14	4	27	45
	<u>Channel</u>	<u>Disposal</u>	<u>Mitigation</u>	
Channel Improvement	13	9	5	27

Total acreage required by the project equals 167 acres, of which 17 acres would remain approximately in the same land use as at present under without project conditions due to growth and development in the area. About 46 acres would be dedicated to project use such as dam construction but are subject to development, therefore, no significant change in environmental or ecological values are expected. The 13 acres of aquatic and streambank habitats required for channel improvement would be adversely affected. About 42 acres were subject to loss

through development but would be retained in project and recreation use. Preservation of this acreage and revegetation with increased public use would result in minor enhancement compared to without project conditions. An additional 47 acres, subject to development under without project conditions, would be preserved due to the project and recreation use and are valued as major enhancement acreages.

Selective measures would be employed during dam and channel construction to reduce short term adverse impacts. These measures include erosion control, dust control, and seeding of disturbed areas to confine adverse impacts as much as possible.

The reduction of flood hazards to downstream properties preserves neighborhood aesthetic qualities and enhances community cohesion. Plan H requires acquisition of one apartment building, containing 12 units, and therefore requires relocation of approximately 12 potential families. As rental property, however, the movement of people would naturally have occurred under without project conditions to some extent.

A major drawback of Plan H is that at a 35-year degree of protection, minimum desirable levels of protection to public health and safety result.

Economic analysis for Plan H is presented in Table 13.

TABLE 13
PLAN H (NED)
ECONOMIC SUMMARY

Item	Amount (October 1980 Values)
Initial Construction Cost	\$11,480,000
Annual Economic Costs	1,097,000
Annual Benefits	
Flood Damages	1,037,000
"Emergency" Savings	54,000
Flood Insurance Administration Savings	19,000
Operation and Maintenance Savings	12,000
Open Space	224,000
Recreation	459,000
Total Annual Benefits	\$ 1,805,000
Net Benefits	708,000
Benefit to Cost Ratio with Recreation	1.6
Benefit to Cost Ratio without Recreation	1.5

Evaluation and Tradeoff Analysis

Plan H provides net contributions to established NED and EO objectives. Plan H further includes features and concepts which realize opportunities for the basin's resources. Plan H meets with general acceptance and shares benefits and adverse impacts equitably among upstream and downstream interests. The major tradeoff required by Plan H, however, is that selection of this plan foregoes the opportunity for a more acceptable and higher degree of protection in exchange for that plan which maximizes net benefits, i.e. net contributions to NED.

Implementation Responsibilities

The Flood Control Act of 1936, as amended, establishes the present basis for Federal and nonfederal sharing responsibilities in the construction, operation and maintenance of Federal water resources projects. However, President Carter's water policy statement, contained in his Message to Congress on 6 June 1978, proposed changes to existing

cost sharing policy. Discussion in the following paragraphs will provide data for the present policy and President Carter's proposal.

Cost Apportionment

Sharing of costs between Federal and nonfederal interests for Plan H based on the present policy for local protection improvements is shown in Table 14. Under present policy, the Federal Government will design and prepare detailed plans and specifications, award construction contracts, and supervise and administer contractors for construction of the project. The completed project would be annually inspected by Federal inspectors to assure that it remains effective and serves intended purposes.

TABLE 14
PLAN H (NED)
COST APPORTIONMENT

Item	Present Policy	President Carter's Proposal
<u>First Cost</u>		
Flood Control (10,340,000)		
Federal	\$7,420,000	\$7,755,000
Local	2,920,000	2,068,000
State	---	517,000
Recreation (1,140,000)		
Federal	570,000	513,000
Local	570,000	570,000
State	---	57,000
<u>Annual Operation and Maintenance and Major Replacement</u>		
Local		
Flood Control	25,000	25,000
Recreation	91,000	91,000

Under present policy, local interests would be required to furnish all lands and rights-of-way, including relocation assistance, and the modification of all streets, roads and utilities. The nonfederal portion of project costs, therefore, is the estimated cost, at current price levels, to accomplish this work. Under President Carter's proposal, the first cost would be shared between Federal (75%), local (20%), and state (5%).

Under both policies, the annual project operation and maintenance costs are 100 percent nonfederal.

Additional Nonfederal Responsibilities

Under both the existing and proposed policies, the following is required of nonfederal interests.

Hold and save the United States free from damages due to construction works, excluding damages due to the fault or negligence of the United States or its contractors.

At least annually inform affected interests regarding the limitation of protection afforded.

Prescribe and enforce regulations to prevent obstructions or encroachments in the floodway which would reduce their flood control purposes or hinder their operation and maintenance.

Comply with the applicable provisions of the Uniform Relocations Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646d) and Section 601, Title VI, of the Civil Rights Act of 1964 (Public Law 83-352).

Public Views

The U. S. Fish and Wildlife Service has participated in the study by furnishing a detailed inventory and analysis of the existing fish and wildlife values and resources of the stream aquatic environments and basin wildlife populations and habitat. Coordinated field inspection trips were made with Fish and Wildlife representatives, local interests, and members of the Louisville District planning staff. Pertinent correspondence is included in Appendix C.

The views of nonfederal agencies and local interests were obtained through numerous coordination meetings and workshops held for various aspects of the study. Coordination has been maintained with the Miami Conservancy District, officials of the City of Fairfield, special interest groups, and homeowners associations in the project area.

In general, the concept of Plan H is acceptable to Federal agencies and local interests. Various details of the project, including cost sharing, recreation scoping, open space preservation, and project design were of special interest. Local interests share concern for the minimum level of protection provided by Plan H.

PLAN J

Plan Description

Plan J is a tradeoff plan designed to test a higher degree of protection than the 35-year provided by Plan H against environmental and economic criteria pertinent to assessment and evaluation. It has previously been shown that the addition of reservoir storage and/or nonstructural measures are not a cost effective means of increasing protection levels for Plan H. Therefore, Plan J consists of the three dry bed reservoirs (Sites A, C, and D) in combination with channel enlargement for a 100-year degree of protection. The reservoir components of Plan J are the same as for the previously described Plan H. Channel enlargement in Plan J for the 100-year degree of protection includes 0.83 mile of channel widening between Mile 3.52 and

Nilles Road (Mile 2.60) to widths of 50 to 60 feet, gabion channel work on the left bank in Reach PR-3 for about 0.4 mile, and channel widening for about 0.14 mile from Mile 1.86 downstream to East River Road bridge (50-foot bottom width). Plan J involves about 0.54 mile additional channel work plus replacement of the East River Road bridge over Plan H. All other features of Plan J, including recreation, remain the same as for Plan H.

Impact Assessment

Plan J output substantially eliminates flood damages from out of bank flows up to a 100-year frequency flood event (under future runoff conditions) and would reduce the potential damage from larger floods. Average annual flood damages are reduced by 97 percent. While damage from an occurrence of the SPF, with Plan J in operation, would be reduced 58 percent, damages as a result of a 500-year frequency flood would be reduced 90 percent. Net contributions to NED by flood control elements of Plan J are \$304,000 annually.

Additional net contributions to NED by Plan J's recreation features total \$272,000 annually by creating opportunities for 255,000 annual recreation days of urban oriented outdoor recreation.

Channel enlargement throughout 1.37 miles of the basin's 10.8 miles of streams will result in removal of streambank vegetative cover and will degrade the existing aquatic environment during construction. Provision of pool and riffle complexes and a low flow channel in these areas will reduce construction impacts to the extent possible.

Impacts of the project on the basin's open space and terrestrial areas result in net beneficial contributions to study objectives. Total acreage (fee and easements) required by the project equals about 174 acres of which 47 acres of open space and wildlife habitat will be preserved.

Construction techniques will be the same as Plan H for reduction of temporary adverse effects.

Community cohesion is increased over Plan H. Families in rental units subject to relocation will be the same as Plan H.

Economic analysis for Plan J is presented in Table 15.

TABLE 15
PLAN J (TRADEOFF)
ECONOMIC SUMMARY

Item	Amount (October 1980 Values)
Initial Construction Cost	\$13,040,000
Annual Economic Costs	1,244,000
Annual Benefits	
Flood Damages	1,043,000
"Emergency" Savings	57,000
Bridge Replacement	4,000
Flood Insurance Administration Savings	22,000
Operation and Maintenance Savings	16,000
Open Space	224,000
Recreation	459,000
Total Annual Benefits	\$ 1,825,000
Net Benefits	581,000
Benefit to Cost Ratio with Recreation	1.5
Benefit to Cost Ratio without Recreation	1.3

Evaluation and Tradeoff Analysis

Plan J provided net contributions to established NED and EQ objectives. Plan J further includes features and concepts which realize opportunities for the basin's resources. Plan J meets with general public acceptance and shares benefits and adverse impacts equitably. The major tradeoff required by Plan J is that a more acceptable degree of protection (100-year) is furnished in exchange for increased environmental damages along 0.54 mile of Pleasant Run Creek.

Implementation Responsibilities

Implementation responsibilities are the same as shown for Plan H.

Cost Apportionment

Cost sharing policies and responsibilities are the same as shown for Plan H. Apportioned costs for Plan J are shown in Table 16.

TABLE 16

PLAN J (TRADEOFF) COST APPORTIONMENT

Item	Present Policy	President Carter's Proposal
<u>First Cost</u>		
Flood Control (11,900,000)		
Federal	\$8,270,000	\$8,925,000
Local	3,630,000	2,380,000
State	---	595,000
Recreation (1,140,000)		
Federal	570,000	513,000
Local	570,000	570,000
State	---	57,000
<u>Annual Operation and Maintenance and Major Replacement</u>		
Local		
Flood Control	36,000	36,000
Recreation	91,000	91,000
<u>Public Views</u>		

Information furnished for Plan H is also applicable for Plan J with the exception that more support was expressed for this plan due to the higher degree of protection furnished. However, some social and environmental concerns over the channel improvement component have been expressed.

PLAN I (EQ AND NONSTRUCTURAL)

Plan Description

Plan I which includes major nonstructural components is designated the EQ plan because it maximizes net contributions to the EQ objectives and more fully realizes environmental quality opportunities. Plan I provides 100-year degree of protection and consists of three dry bed reservoirs with flood proofing, evacuation, relocation, and recreation. Plan I involves construction of three dry bed reservoirs the same as in Plans H and J. Property located within the modified 100-year flood limits were then flood proofed (if engineeringly feasible), evacuated, or relocated in order of cost effectiveness so that a uniform 100-year degree of protection results. This procedure resulted in 291 properties subjected to flood proofing, 35 properties evacuated, and 14 properties relocated. Vacant areas residual to evacuation and relocation were then converted to open space and urban oriented, day use recreation areas.

Impact Assessment

Plan I output substantially eliminates flood damages from out of bank flows up to a 100-year frequency flood event (under future runoff conditions) and would reduce the potential damage from larger floods. Average annual flood damages are reduced by 98.5 percent while damage from an occurrence of the SPF with Plan I in operation would be reduced approximately 70 percent. The net contribution to NED from the flood control component is \$41,000 annually.

Additional net contributions to NED by Plan I's recreation features total \$272,000 by creating opportunities for 255,000 annual recreation days of urban oriented outdoor recreation.

Construction of the three dry dams eliminates 0.3 mile of stream-bank and aquatic stream environment in the basin as a result of dam construction and preserves 1.0 mile of channel by preservation in

ponding areas. A net 42 acres of wildlife habitat are preserved under Plan I.

Community cohesion is adversely affected through the relocation and evacuation of 49 homes and 12 apartment units. Beneficial effects result to community cohesion from the improved conditions for public health and safety. While these benefits accrue through the reduction in the flood hazard risk, some 291 homes (flood proofed by Plan I) would remain surrounded by water for occurrence of the 100-year frequency flood event.

Economic analysis for Plan I is presented in Table 17.

TABLE 17
PLAN I (EQ AND NONSTRUCTURAL)
ECONOMIC SUMMARY

Item	Amount (October 1980 Values)
Initial Construction Cost	\$17,740,000
Annual Economic Costs	1,630,000
Annual Benefits	
Flood Damages 1/	1,175,000
"Emergency" Cost Savings	60,000
Flood Insurance Administration Savings	22,000
Operation and Maintenance Savings	10,000
Open Space	224,000
Recreation	459,000
Total Annual Benefits	\$ 1,950,000
Net Benefits	320,000
Benefit to Cost Ratio with Recreation	1.2
Benefit to Cost Ratio without Recreation	1.04

1/ Includes recreation and open space benefits associated with nonstructural component.

Evaluation and Tradeoff Analysis

While Plan I makes favorable improvements on the percent average annual flood damage reduction and creates more open space as a result of

the use of nonstructural measures, the plan meets with less public acceptability. Although all structures receive a 100-year degree of protection, access remains impaired for fire and medical emergency vehicles during flood times. Generally, the reduced impact to the stream environment and increased open space are the favorable impacts of Plan I and are obtained in trade for higher implementation costs, and less public acceptance due to impacts on community cohesion and the residual flood condition effects on emergency vehicle access.

Implementation Responsibilities

Implementation responsibilities are the same as shown for Plans H and J.

Cost Apportionment

Sharing of costs between Federal and nonfederal interests for the structural components of Plan I are the same as defined under Plans H and J. For the nonstructural components, existing policy requires cost sharing of 80 percent of the total Federal cost and 20 percent nonfederal. Under President Carter's cost sharing proposal, the first cost would be shared between Federal (75%) and local (20%), and state (5%). All operation and maintenance costs are 100 percent nonfederal for both cost sharing methods. Table 18 shows the apportioned first cost of construction and the annual operation and maintenance costs for Plan I.

Public Views

Information is the same as for Plan H, with the exception that more concern was expressed over the nonstructural components.

TABLE 18
PLAN I (EQ AND NONSTRUCTURAL)
COST APPORTIONMENT

Item	Present Policy	President Carter's Proposal
<u>First Cost</u>		
Flood Control (16,600,000)		
Federal	\$12,470,000	\$12,370,000
Local	4,130,000	3,400,000
State	---	830,000
Recreation (1,140,000)		
Federal	570,000	510,000
Local	570,000	570,000
State	---	60,000
<u>Annual Operation and Maintenance and Major Replacement</u>		
Local		
Flood Control	27,000	27,000
Recreation	94,000	94,000

PLAN K (TRADEOFF)

Plan Description

Plan K is a tradeoff plan and is presented as the only structural alternative to the reservoir plans that exhibited economic feasibility and, therefore, has implementation prospects in the event that lands necessary for dry bed reservoirs cannot be preserved. Plan K includes channel enlargement throughout stream Reaches PR-2 through PR-6, for a distance of 2.92 miles. Channel depth varies from 9 to 14 feet, while bottom width varies from a minimum of 65 feet to a maximum of 195 feet. The channel enlargement is accomplished by excavation and the provision of riprap and concrete side slope construction. Bridge replacements are required at East River Road, Pleasant Avenue and Nilles

Road. Channel right-of-way requires 69 acres and disposal areas of about 60 acres. Recreation is included as a project feature, although substantially limited due to the shallow backyards along the channel and general lack of area available for recreation.

Impact Assessment

Plan K output substantially eliminates flood damages from out of bank flows up to a 35-year frequency flood event (under future runoff conditions) and would reduce the potential damage from a larger flood in stream Reaches PR-2 through PR-6, with some reduction in PR-7. Other stream reaches (PR-8, High School Tributary, and East Fork of Pleasant Run) receive no flood protection due to the limitations on channel extension caused by economic feasibility. Average annual flood damages are reduced by 82 percent while damage from an occurrence of the SPF, with Plan K in operation, would be reduced 46 percent. Net contributions to NED by the flood control elements of Plan K are \$23,000 annually.

Additional contributions to NED by Plan K's recreation features total \$111,000 annually by creating opportunities for 100,000 annual recreation days of urban oriented outdoor recreation.

Channel enlargement throughout 2.92 miles of the basin's 10.8 miles of streams will result in removal of streambank vegetation cover and will degrade the existing aquatic environment during construction. Provision of pool and riffle complexes and a low flow channel in the area will reduce construction impacts to the extent possible.

Economic analysis for Plan K is presented in Table 19.

TABLE 10
PLAN K (TRADEOFF)
ECONOMIC SUMMARY

Item	Amount (October 1980 Values)
Initial Construction Cost	\$10,600,000
Annual Economic Costs	1,000,000
Annual Benefits	
Flood Damages	884,000
"Emergency" Cost Savings	41,000
Flood Insurance Administration Savings	16,000
Bridge Replacement	10,000
Operation and Maintenance Savings	7,000
Recreation	180,000
Total Annual Benefits	\$ 1,138,000
Net Benefits	138,000
Benefit to Cost Ratio with Recreation	1.13
Benefit to Cost Ratio without Recreation	1.03

Evaluation and Tradeoff Analysis

Plan K, the all channel plan, reflects the potential impact of being unable to preserve lands required for dry bed reservoir construction as could result from legal or financial causes. Impacts are primarily environmental, social, and those resulting from economic constraints. Environmentally, the all channel plan, Plan K, requires the elimination of most streambank vegetation throughout the 2.02 miles of stream designated under this plan. The magnitude of channel construction is significantly greater than under Plans H, J, or I. The all channel plan is socially less acceptable than previous plans due to the extensive right-of-way requirements and width of the resulting channel in stream reaches where shallow backyards are predominant. Although residences are not purchased, the significant loss of backyards adversely affects aesthetic values in the affected neighborhoods. The third major area of tradeoff associated with Plan K is its relatively marginal economics. At a benefit to cost ratio of 1.03, this plan is

highly susceptible to erosion of the benefit to cost ratio by increasing interest rates, changed future conditions as might occur prior to construction, and lower priority in receiving further or continued funding.

Implementation Responsibilities

Implementation responsibilities are the same as shown for Plans H, J, and I.

Cost Apportionment

Cost sharing policies and responsibilities are the same as shown for Plans H and J. Apportioned costs for Plan K are shown in Table 20.

TABLE 20

PLAN K (TRADEOFF) COST APPORTIONMENT

Item	Present Policy	President Carter's Proposal
<u>First Cost</u>		
Flood Control (10,300,000)		
Federal	\$5,860,000	\$7,725,000
Local	4,440,000	2,060,000
State	---	515,000
Recreation (300,000)		
Federal	195,000	175,000
Local	195,000	195,000
State	---	20,000
<u>Annual Operation and Maintenance and Major Replacement</u>		
Local		
Flood Control	46,000	46,000
Recreation	35,000	35,000

Public Views

Same as presented for Plan H with the exception that considerable local opposition was voiced against the channel plan as many local residents objected to the possible acquisition of their backyards.

RATIONALE FOR TENTATIVELY SELECTED PLAN

GENERAL

A wide variety of structural and nonstructural measures were evaluated for alleviation of flooding along Pleasant Run and its tributaries in the vicinity of Fairfield, Ohio. Four alternative plans were evaluated in detail for project impacts, their contributions to National Economic and Environmental Quality objectives, and for their realization of basin resource opportunities. This final array of plans included Plan H--35-year, 3 dry bed reservoirs, 0.83 mile of channel enlargement; Plan J--100-year, 3 dry bed reservoirs, 1.37 miles of channel enlargement; Plan I--100-year, 3 dry bed reservoirs, flood proofing, evacuation, and relocation; and Plan K--35-year, 2.92 miles of channel enlargement. All plans included mitigation as appropriate, recreation, and environmental design features for minimization of project impacts. After consideration of views and comments received from other agencies and the general public, and consideration of environmental, social, technical, and economic factors, Plan J was selected as the best plan and is shown in detail on Plate 4 (Sheets 1 through 6). In order to show the effects of Plan J on particular types of resources that are recognized by certain Federal policies, Table 21 is presented.

The flood control component of the selected plan would include construction of dry bed reservoirs on Pleasant Run and its tributaries and approximately 1.37 miles of channel enlargement in order to carry the 100-year frequency flood. The estimated first cost and annual costs for flood control purposes are \$11,900,000 and \$1,056,000, respectively. With average annual benefits of \$1,366,000, the flood control component has a benefit to cost ratio of 1.3. The recreation development consists of the provision of trails, picnic, and outdoor game facilities at the dry bed reservoir sites. Site planning varies from intensive use to moderate use to preservation and nature study themes. The estimated first and annual costs for the recreation purpose are \$1,140,000 and \$187,000, respectively. With average annual benefits of \$459,000, the recreation development has a benefit to cost ratio

TABLE 21
EFFECTS OF THE TENTATIVELY RECOMMENDED PLAN ON RESOURCES OF PRINCIPAL NATIONAL RECOGNITION

Types of Resources	Principal Sources of National Recognition	Measurement of Effects 1/
Air Quality	Clean Air Act, as amended (42 USC 1857h-7 et seq.)	No effect
Areas of Particular Concern within the Coastal Zone	Coastal Zone Management Act of 1972, as amended (16 USC 1451 et seq.)	Not present in planning area
Endangered and Threatened Species Critical Habitat	Endangered Species Act of 1973, as amended (16 USC 1531 et seq.)	Not present in planning area
Fish and Wildlife Habitat	Fish and Wildlife Coordination Act (16 USC Section 661 et seq.)	Woodland: Net 22 acres gained Old Fields: 15 acres gained, but short term loss on another 12 acres Streambanks: Net 5 acres lost Aquatic (Stream): Net 4 acres lost
Flood Plains	Executive Order 11988, Flood Plain Management	100-year flood plain reduced from 722 acres to 203 acres -- net loss of 519 acres
Historic and Cultural Properties	National Historic Preservation Act of 1966, as amended (16 USC Section 470 et seq.)	Not present in planning area
Prime and Unique Farmland	CEQ Memorandum of 1 August 1980: Analysis of Impacts on Prime or Unique Agricultural Lands in Implementing the National Environmental Policy Act	No effect
Water Quality	Clean Water Act of 1977 (33 USC 1251 et seq.)	No effect
Wetlands	Executive Order 11990, Protection of Wetlands Clean Water Act of 1977 (42 USC 1857h-7 et seq.)	Not present in planning area
Wild and Scenic Rivers	Wild and Scenic Rivers Act, as amended (16 USC 1271 et seq.)	Not present in planning area

1/ Measurements based on future with and without plan conditions.

of 2.5. These elements combined for the selected plan result in a first cost of \$13,040,000, annual costs of \$1,244,000, annual benefits of \$1,825,000, and a benefit to cost ratio of 1.5.

The local sponsor, the Miami Conservancy District, is legally and financially capable of sponsoring the plan. The sponsor has furnished a letter of intent (Exhibit C-2) outlining their understanding of the requirements for local cooperation and their comments on and preference for the selected plan over other alternatives.

MAJOR CONSIDERATIONS

A summary of major considerations for the selected plan in respect to environmental, social well being, technical, economic, Executive Order 11988, and Section 404(r) of Public Law 92-500, as amended, aspects is provided below.

Environmental Considerations

Primary concerns of the study were to provide a sufficiently high level of flood protection, and to realize recreation and environmental opportunities of the basin within economic constraints and subject to project impact limitations. The selected plan meets these objectives and realizes significant opportunities within acceptable limits of economic and impact constraints. The most significant adverse impacts on the environment occur to the aquatic and streambank ecological systems in the 1.37 miles of Pleasant Run. The plan includes measures such as a pool/riffle system, a low flow channel, limiting channel construction where possible to one bank only, and fee acquisition of approximately five acres of adjoining hillside wooded habitat, in order to reduce or mitigate project impacts. Analysis of open space and land use under with and without project conditions results in a net beneficial contribution to open space and preserved natural areas on 47 acres.

Social Well Being Considerations

By providing a relatively high degree of flood protection, the plan would provide beneficial impacts on the social well being of the area. Factors reviewed in determining an acceptable degree of protection included:

COMPARISON OF PLAN EFFECTS

Item	Without Condition	Residual Conditions With Plans in Place		
		35-yr (H)	100-yr (J)	SPF
Average Annual Damages (\$1,000)	1,074	51	30	2
Percent Reduction	0	96.5	98.0	99.8
For 500 year Occurrence				
Damage (\$1,000)	9,620	2,520	995	NIL
Percent Reduction	0	74	90	
Units	1,051	307	261	NIL
Acres	876	306	283	NIL
Depth	6.1	1.3	below 1st floor	NIL
For SPF Occurrence				
Damage (\$1,000)	10,630	5,700	5,400	NIL
Percent Reduction	0	46	51	
Units	1,169	784	766	NIL
Acres	967	683	623	NIL
Depth	6.5	3.6	2.4	NIL
Added Cost Increment (\$1,000)	10,300	1,609	8,900	
Added Length of Channel				
Adversely Affected (miles)	.83	.54	1.55	
Benefit-Cost Ratio		1.5	1.3	0.76

Based primarily on the data presented above, the 100-year degree of protection for the selected plan presents an acceptable limit in the tradeoffs involved. The choice of a 100-year degree of protection at \$1.6 million additional cost and 0.54 mile extension of channel enlargement over the 35-year provides fuller realization of the opportunities available for providing flood protection. Economic criteria are favorable and implementation prospects remain strong. Extending the level of protection beyond the 100-year level results in rapidly eroding economic factors and does not produce sufficient increments of

improvement to public health and safety to warrant the added environmental and social impacts of channel enlargement. Implementation prospects are substantially less favorable at this higher level of protection both for economic and social impact reasons.

The selected plan provides an acceptable balance between flood damage reduction, provision of recreation opportunities, and the preservation of open space and environmental attributes of the stream and basin ecology. Benefits and costs of the selected plan are shared equitably throughout the basin for the selected plan.

Technical Considerations

Elements of the selected plan consisting of flood retarding reservoirs and channel improvement are proven measures for reducing floods. Flow reductions attributable to the reservoirs would prevent any induced flood heights below the channel improvement element. Each reservoir is designed to store at least the 500-year flood and spillways are designed to carry the probable flood. This flood is a hypothetical flood that might be expected to occur from the theoretically greatest depth of precipitation for a given duration that is physically possible over the drainage area. These reservoir features and the channel improvement design are based on future runoff conditions, when the entire drainage basin is projected to be essentially urbanized. The selected plan assures that a high degree of protection will be furnished for the life of the project.

Economic Considerations

By reducing flood damages, the selected plan would result in economic savings to the region and the nation. The net contribution to National Economic Development as a result of the plan is \$581,000 annually, with \$310,000 annually attributable to the flood control component and \$271,000 attributable to the recreation opportunities realized through joint use of project features. The benefit to cost ratio is 1.5. Although some potential for loss of tax revenues exists,

increased value of property bordering created open space and recreation areas, and the flexibility of zoning adjustments and adjusting density concentrations in other developed areas of the basin and community, minimize any potential impacts.

Sensitivity analysis for various alternate conditions (different from the most selected most probable future condition) are presented in Appendix E. The selected plan remains economically feasible up to an applicable Federal interest rate of 12-1/4 percent.

Consideration of Executive Order 11988

The objective of the Executive Order (EO) has been considered in the formulation of plans for this study. The following determinations have been made in response to requirements of EO 11988.

a. In order to achieve the desired objectives of providing flood protection to existing development in the base flood plan, the proposed project must be located in the flood plain. While channel enlargement and dam construction occur in the flood plain, preservation of flood plain land results from the dry reservoir's construction. Preservation of flood plain lands as open space through project utilization prevents development for residential uses as would have occurred without the project. No practical nonflood plain alternative existed.

b. Protection of existing structures in the flood plain required some action in the flood plain. Various alternatives, both structural and nonstructural, were considered for accomplishing the objective. After consideration of economic, environmental, and social factors, and the desire of local interests, the 100-year, three dry bed reservoir, channel enlargement, and recreation plan was selected as the best plan.

c. The proposed action does not conflict with applicable state or local standards concerning flood plain protection.

d. The proposed action will affect the natural and beneficial values of the flood plain. Some 1.37 miles of streambank and adjacent

vegetation will be permanently altered and the aquatic habitat will be temporarily altered.

e. In order to minimize the adverse environmental impacts of the proposed action, environmental design features and other project actions are utilized that result in net contributions to environmental quality. These include the following:

(1) For certain segments of channel construction, limiting channel construction to the streambed and one bank only while leaving the other bank in its natural condition.

(2) Disturbed areas will be seeded and planted as soon as possible after construction.

(3) During construction, measures will be implemented to reduce erosion and dust.

(4) The improved channel will have structures to provide pools and riffles for maintaining/restoring the aquatic life of the stream.

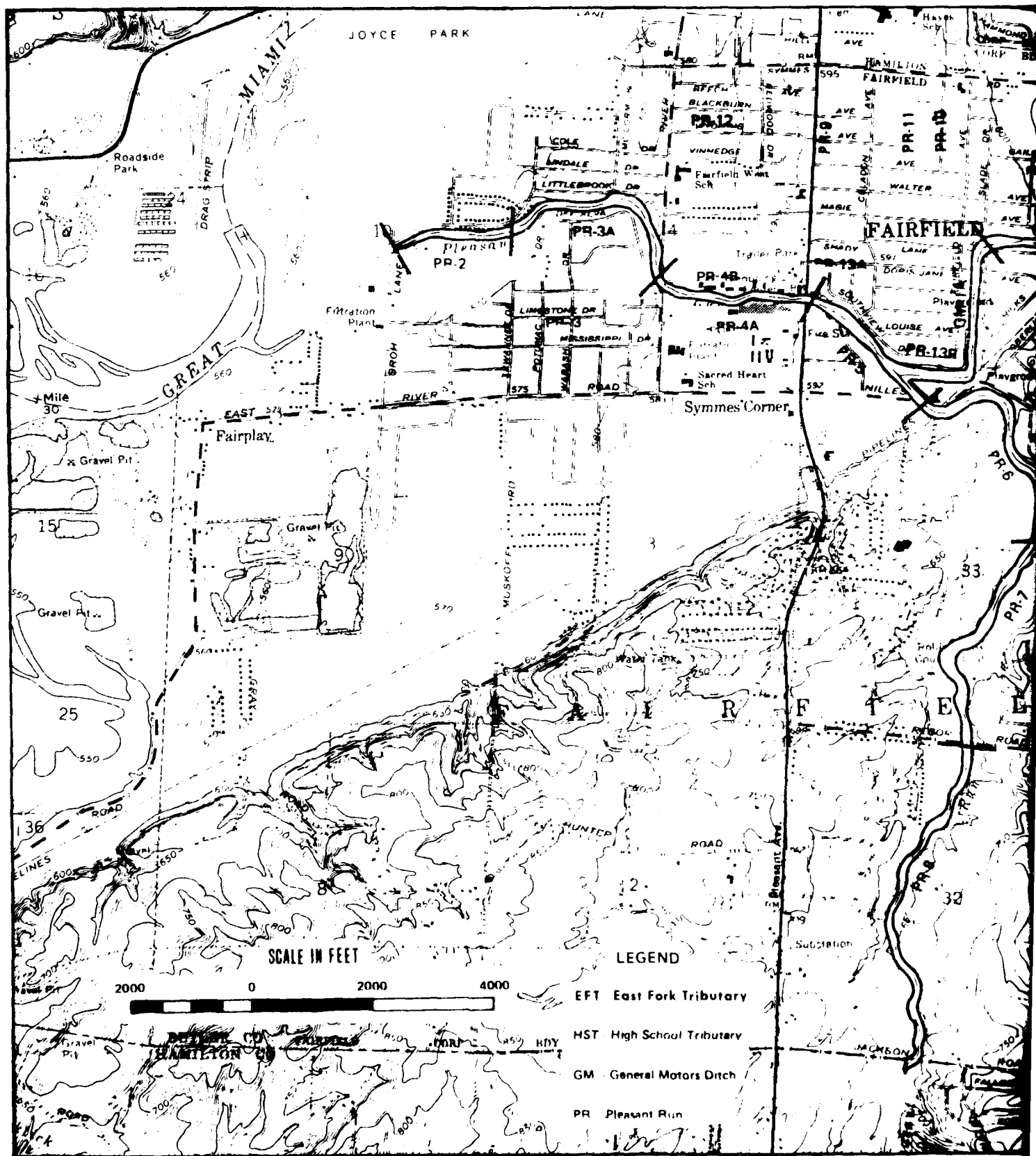
(5) A low flow channel will be included in the design to prevent adverse impacts associated with dry periods.

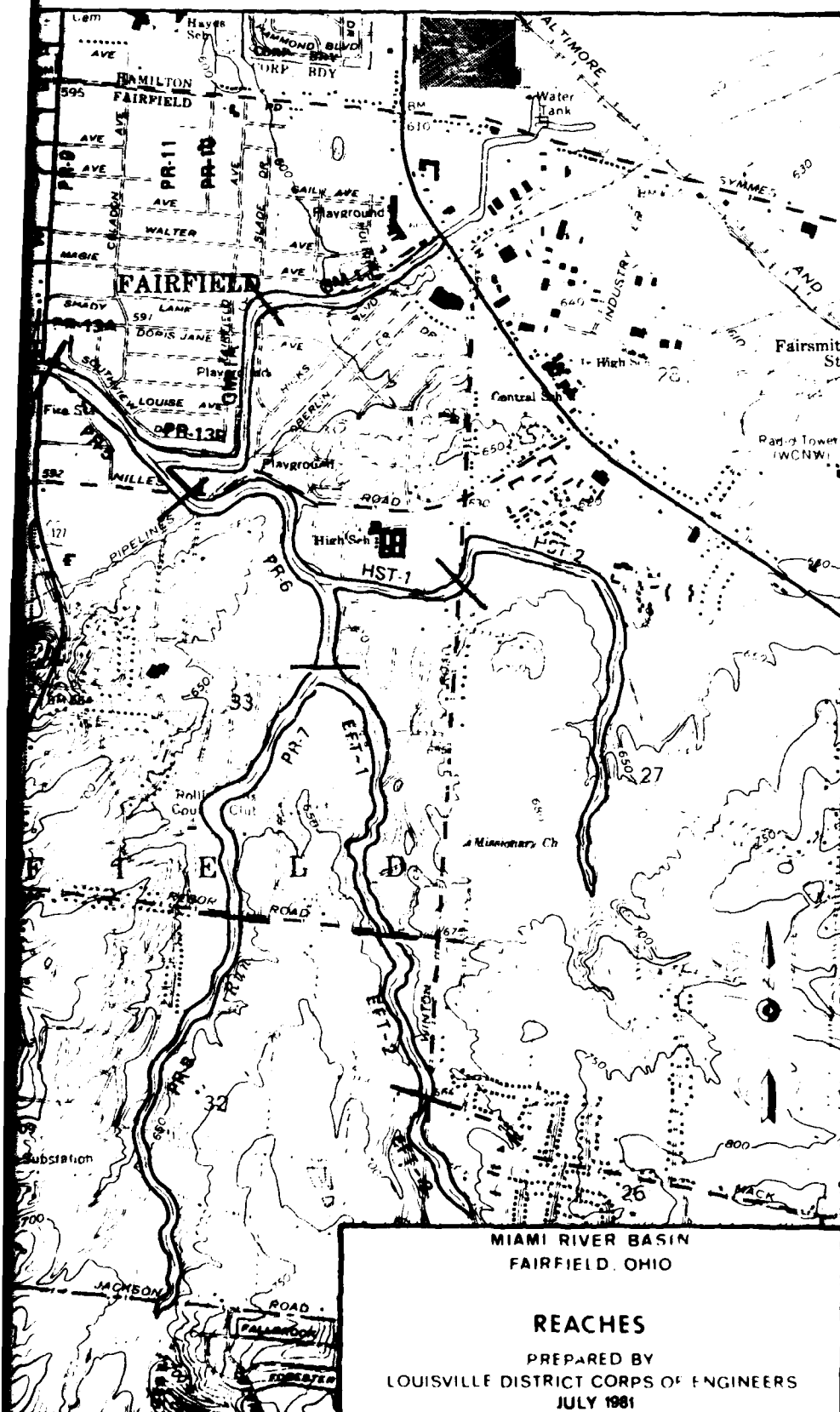
(6) Effects of the reservoir construction result in preservation of 130 acres of open space through project use that would otherwise have been subject to development.

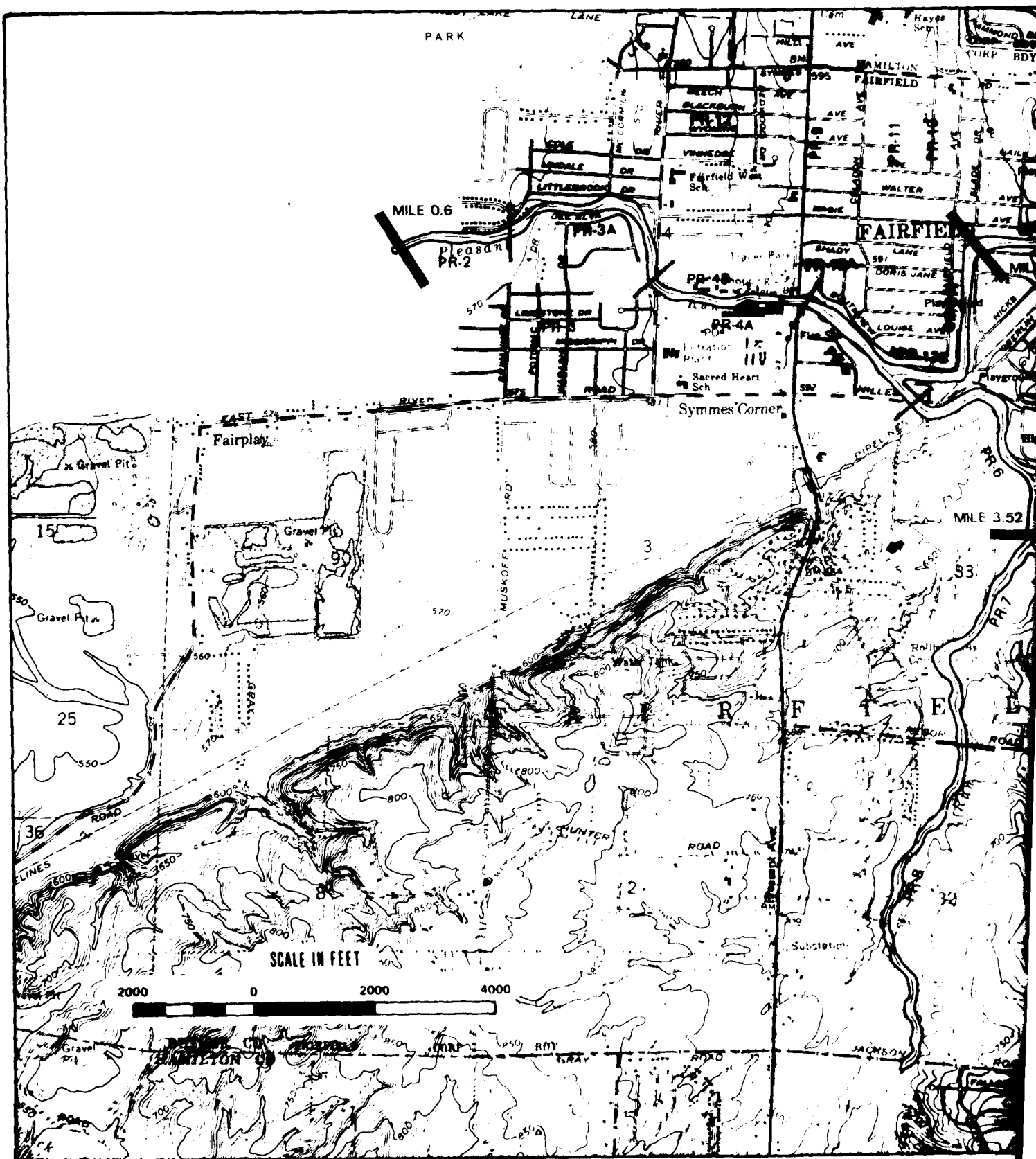
f. The plan also includes as a mitigation feature, the preservation of about 5 acres of project adjoining hillside for wildlife and environmental quality.

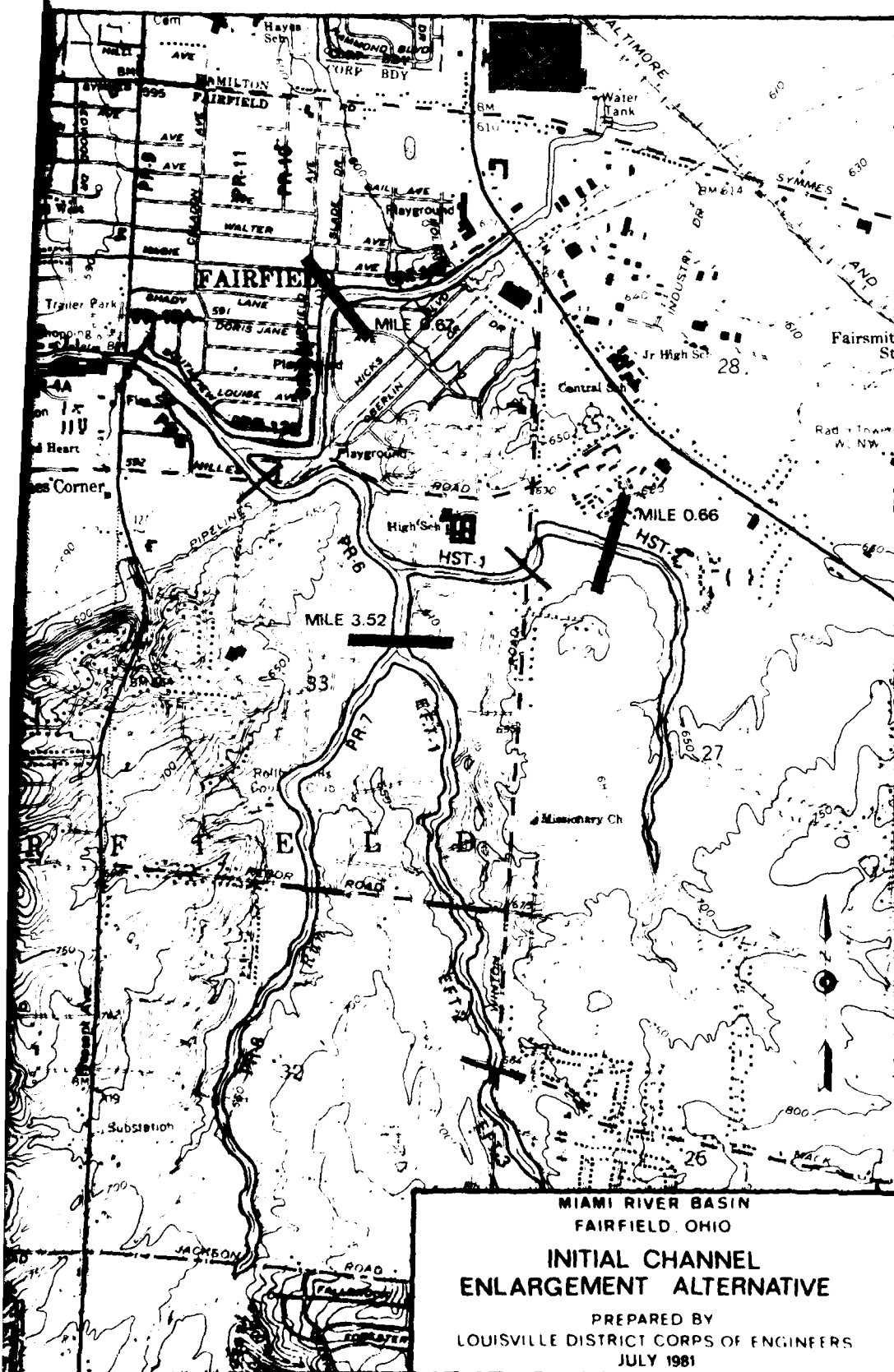
g. The plan includes recreation facilities for day use activities.

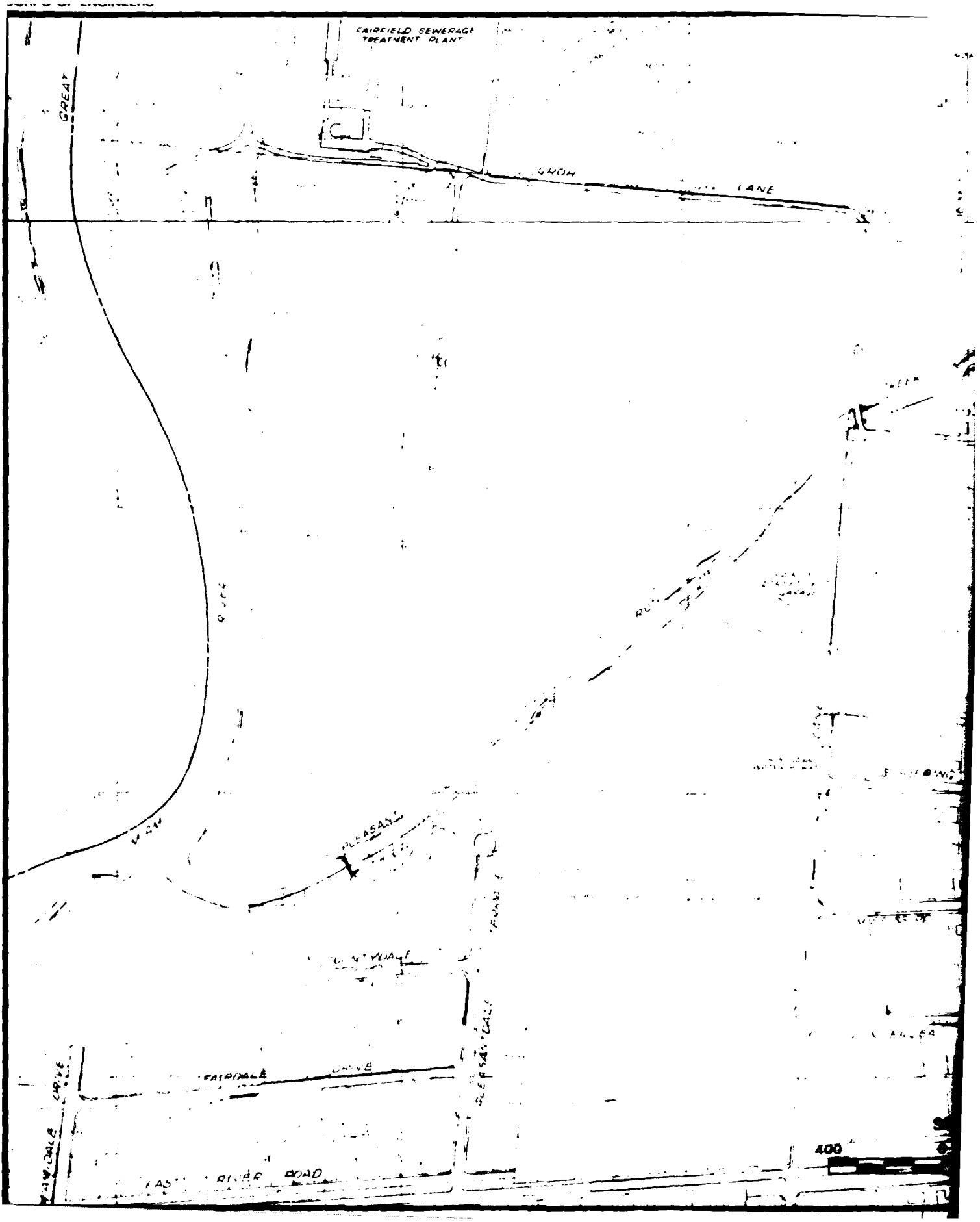
h. This study and the formulation of the proposed action have been coordinated with appropriate Federal, state, and local agencies and interested groups and individuals. A general listing of those involved in the study is contained in the Environmental Impact Statement. Public meetings were held in Fairfield, Ohio on 20 November 1980 and 12 November 1981, concerning the study, alternatives considered, and plan selection.

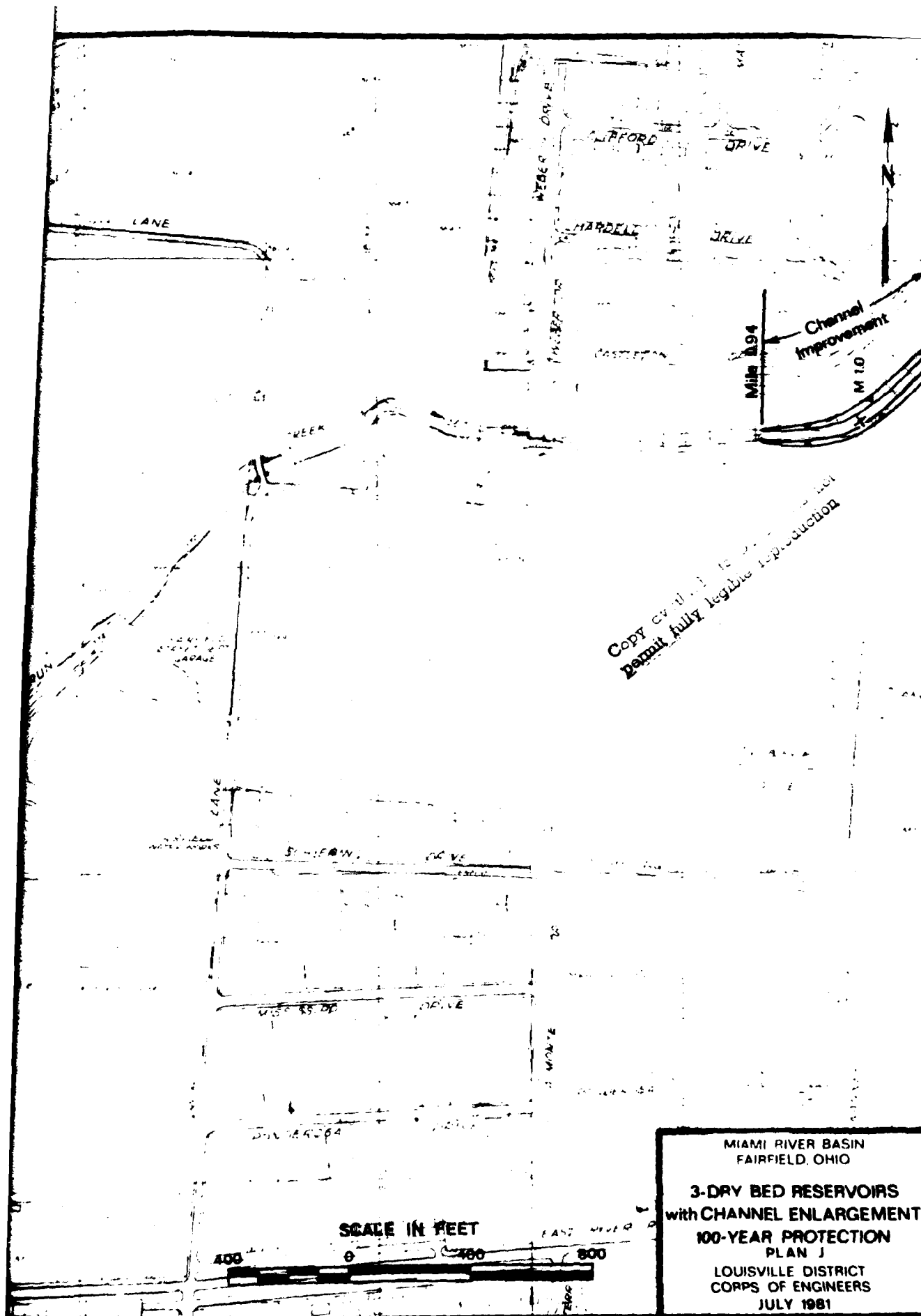


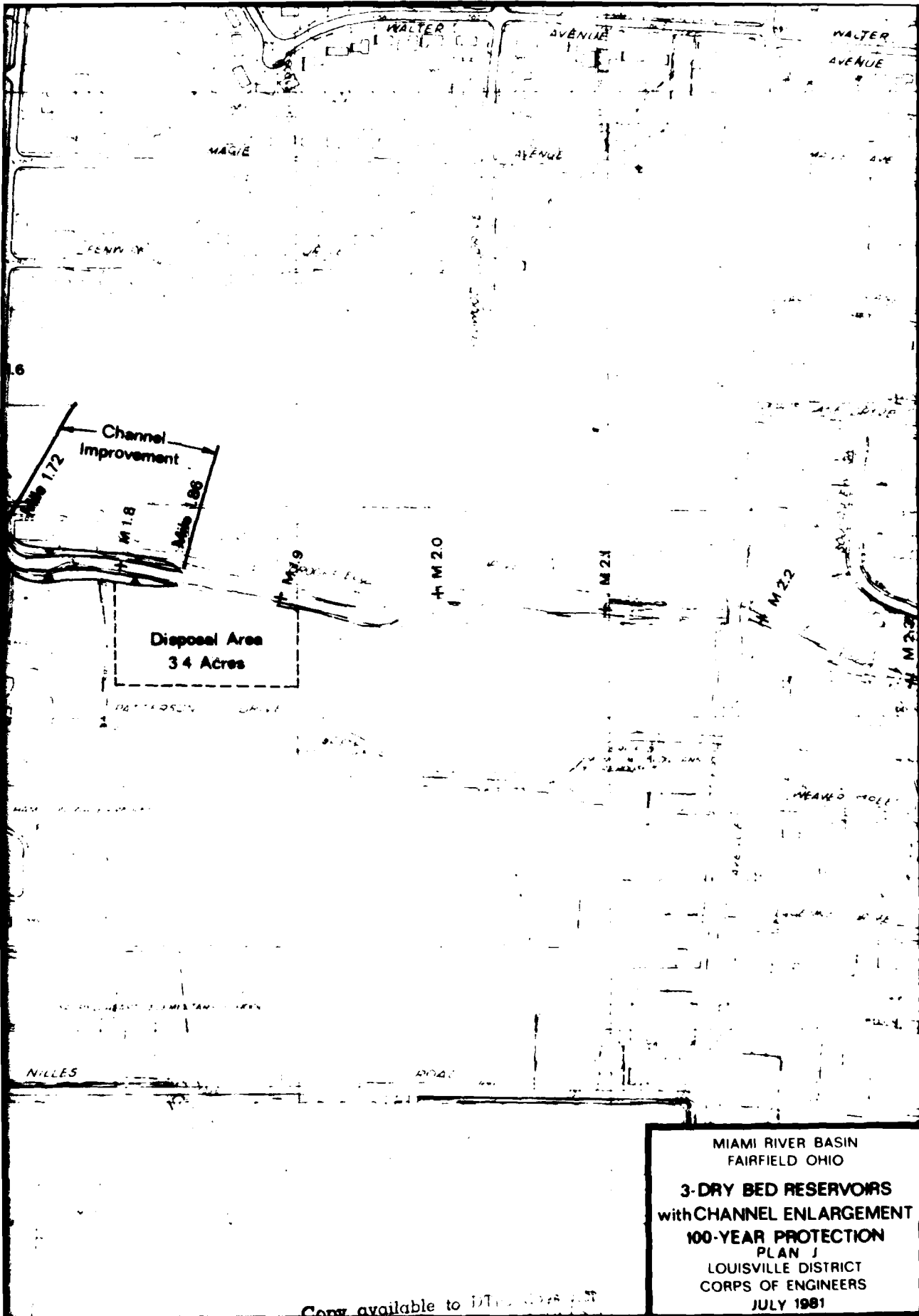












AD-A111 737

ARMY ENGINEER DISTRICT LOUISVILLE KY
WATER RESOURCES DEVELOPMENT MIAMI RIVER, LITTLE MIAMI RIVER, AN--ETC(U)
OCT 81

F/6 13/2

UNCLASSIFIED

NL

2 OF 2

AD-A



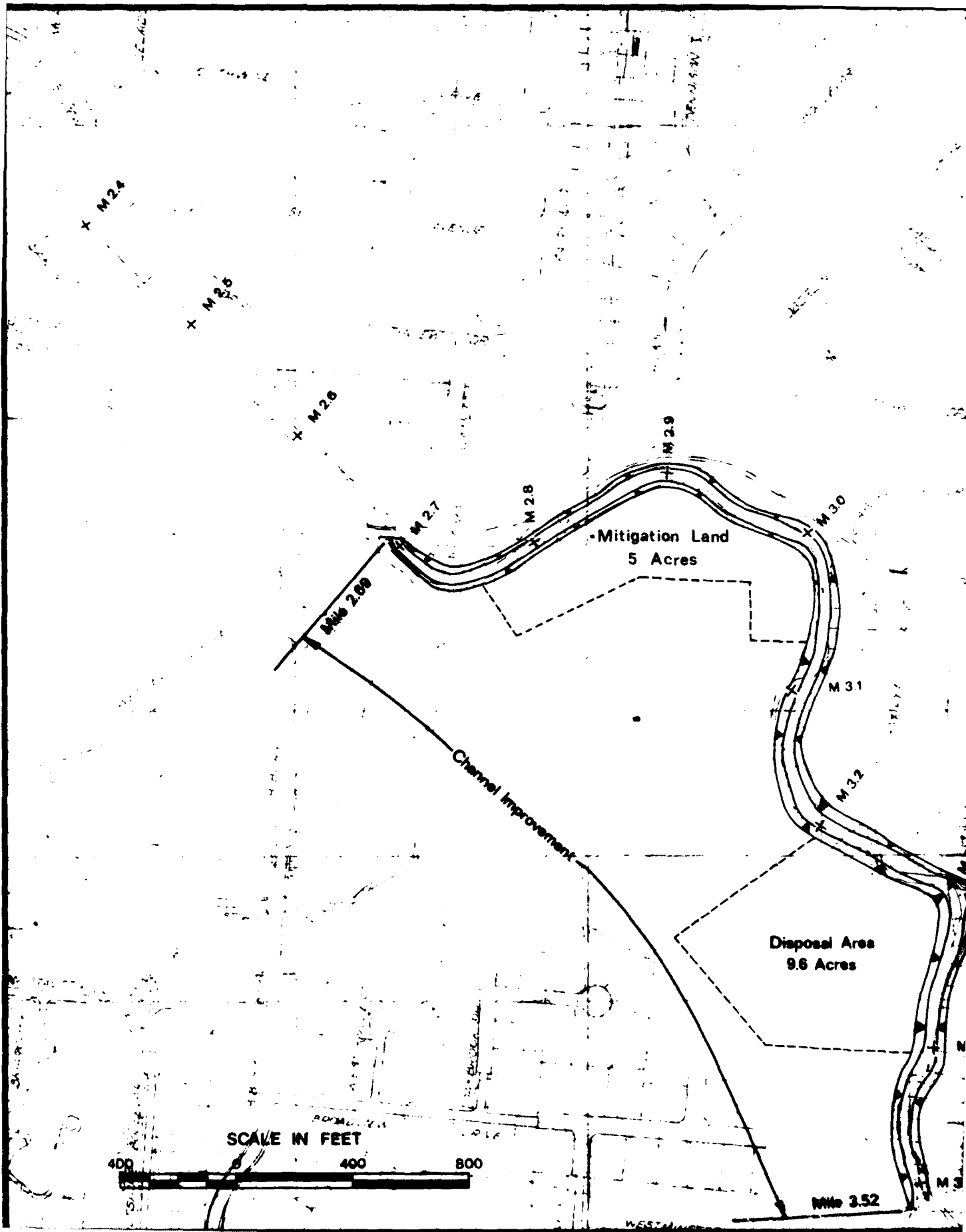
END
DATE
FILMED
04-82
DTIC

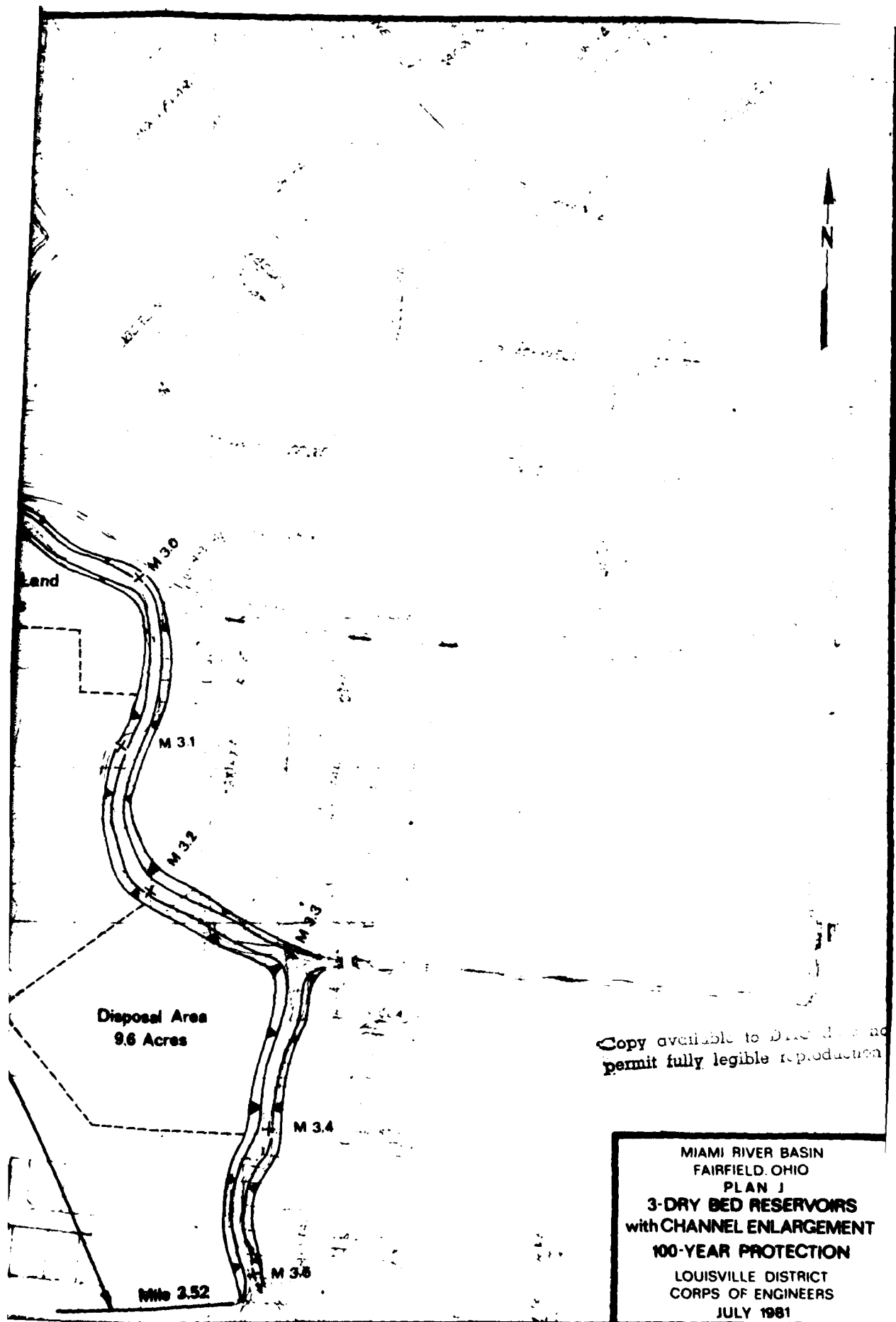


2.8 2.5

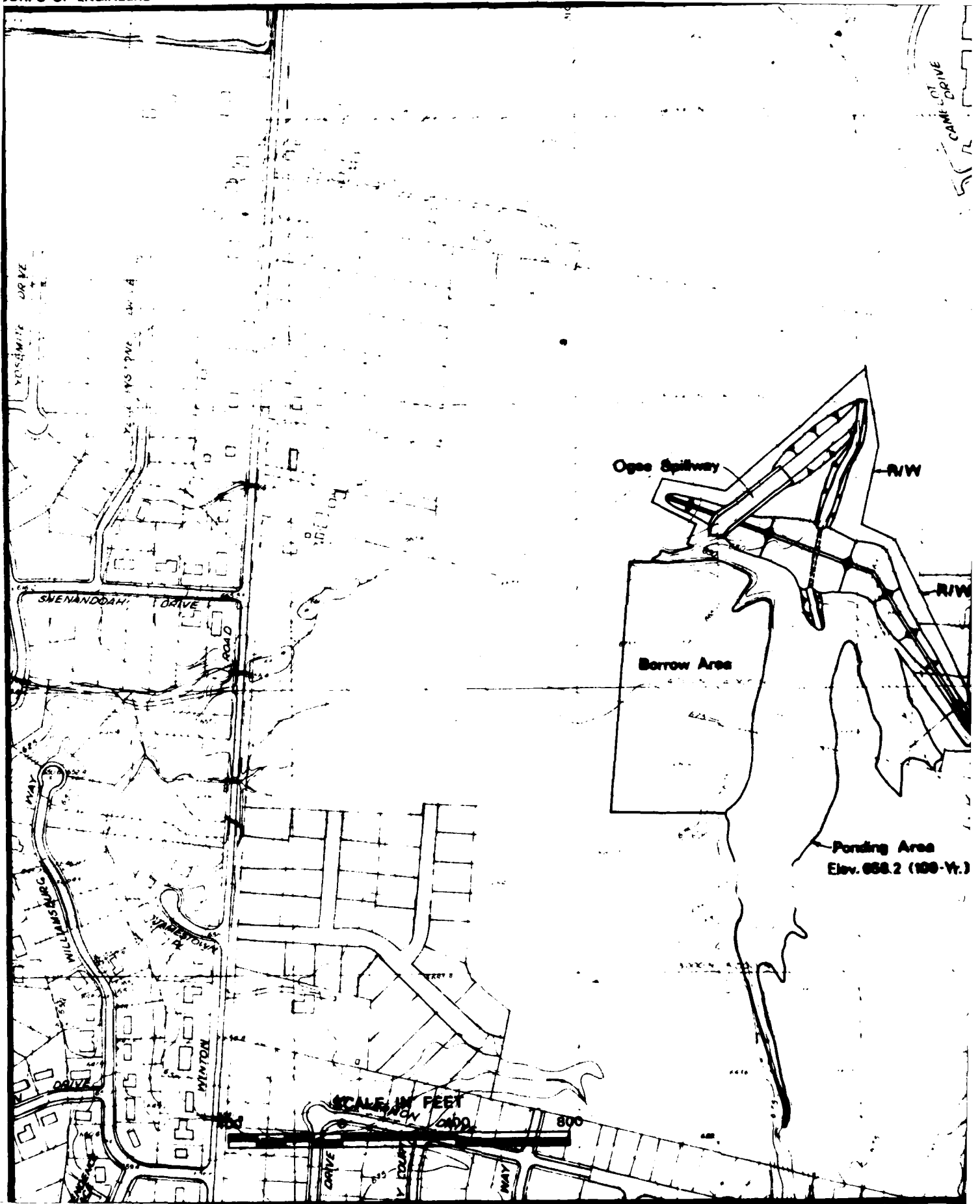


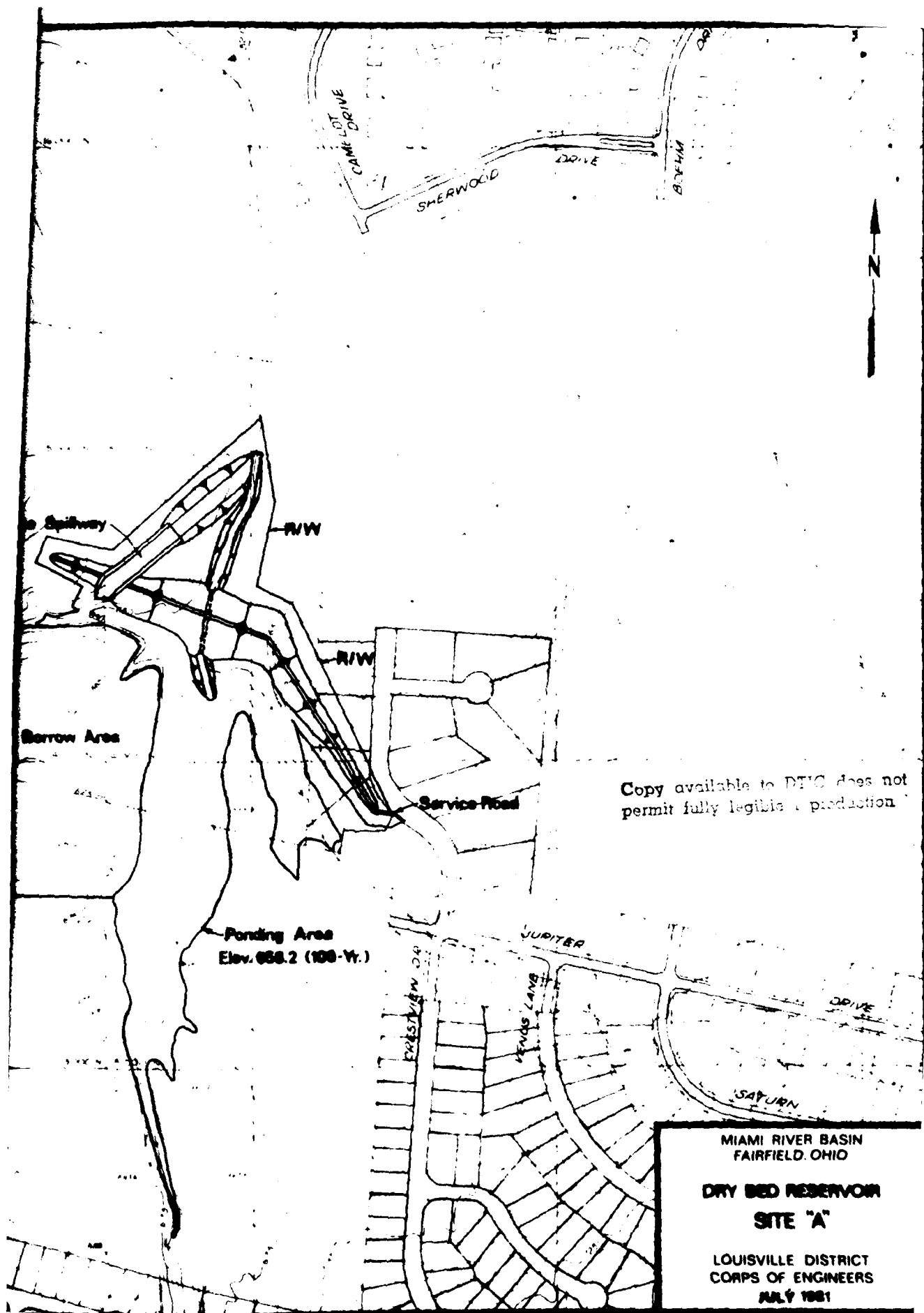
Minimum Resolvable Pattern Size (lp/mm)

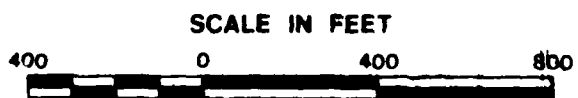
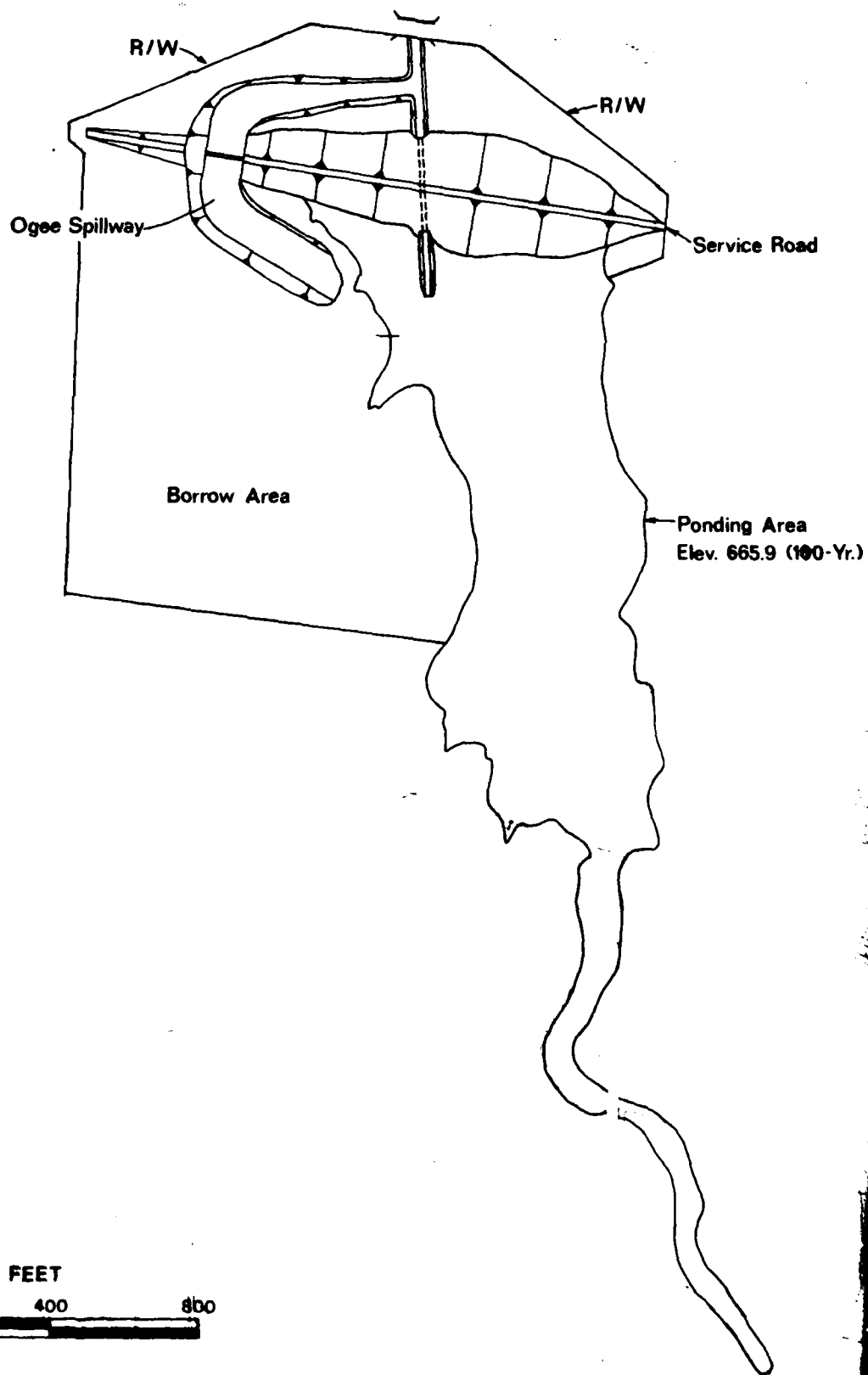


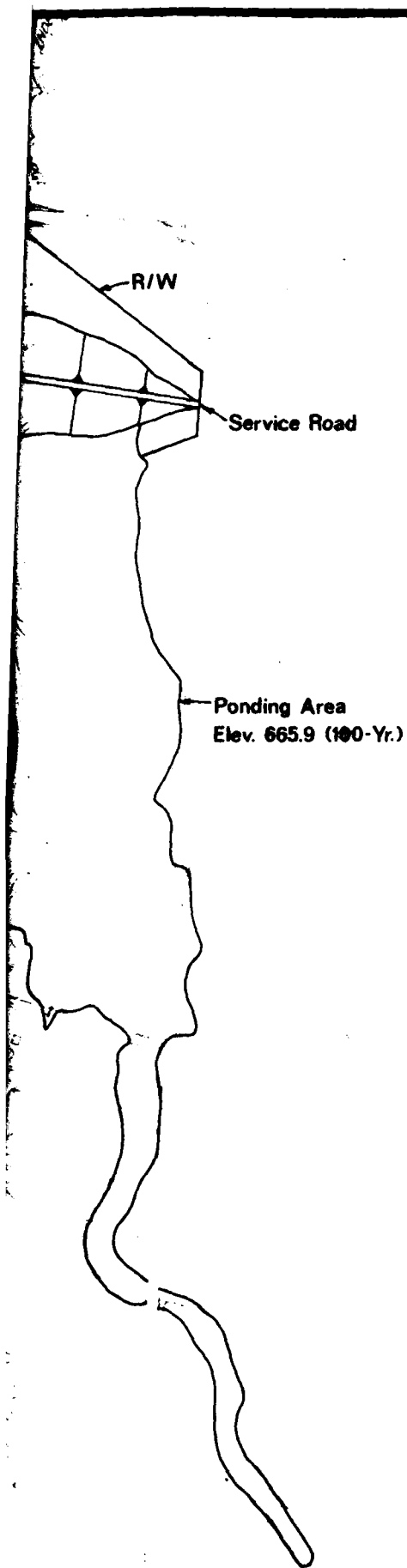


MIAMI RIVER BASIN
FAIRFIELD, OHIO
PLAN J
3-DRY BED RESERVOIRS
with CHANNEL ENLARGEMENT
100-YEAR PROTECTION
LOUISVILLE DISTRICT
CORPS OF ENGINEERS
JULY 1981









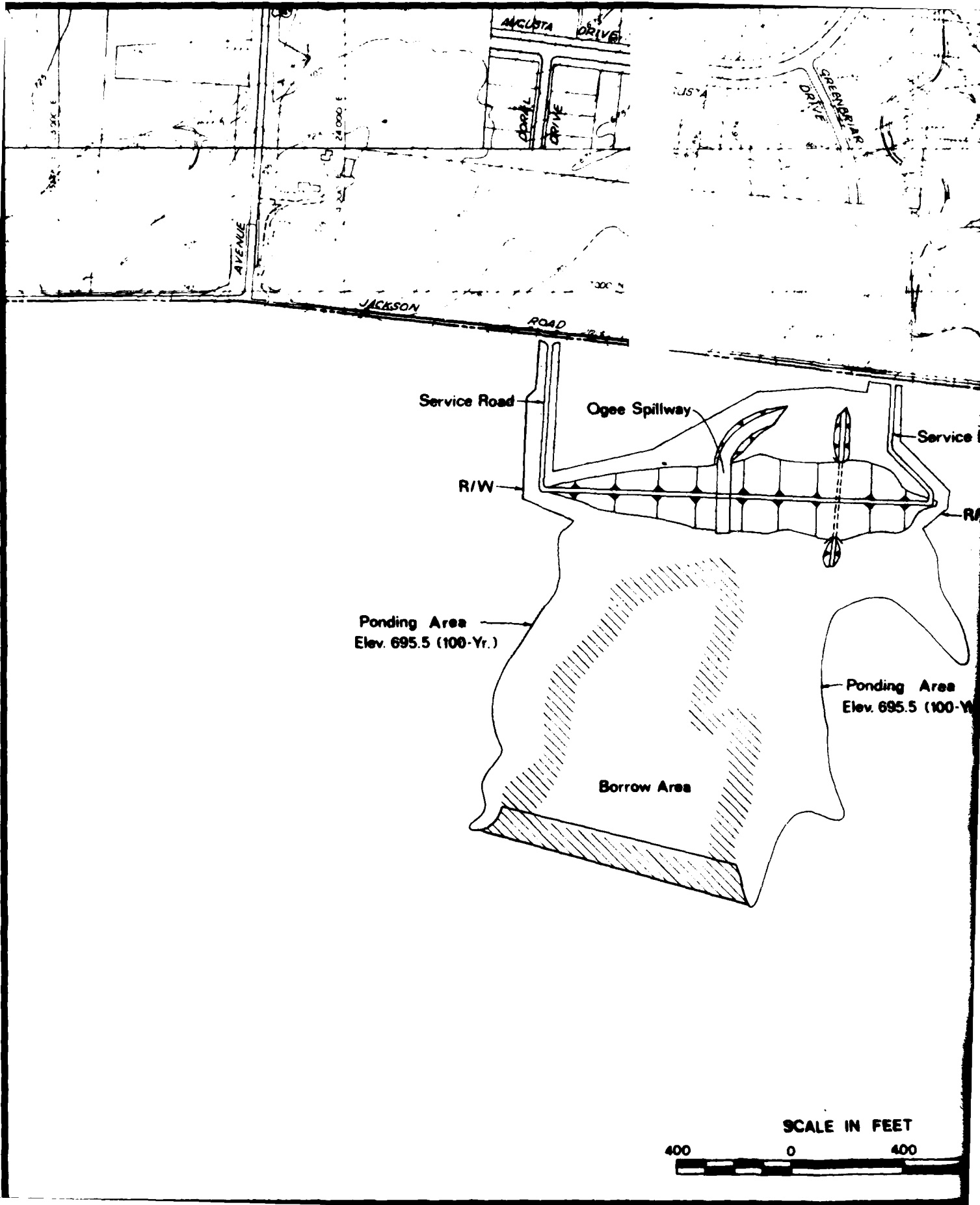
Copy available to District Engineer
permit fully legible reproduction

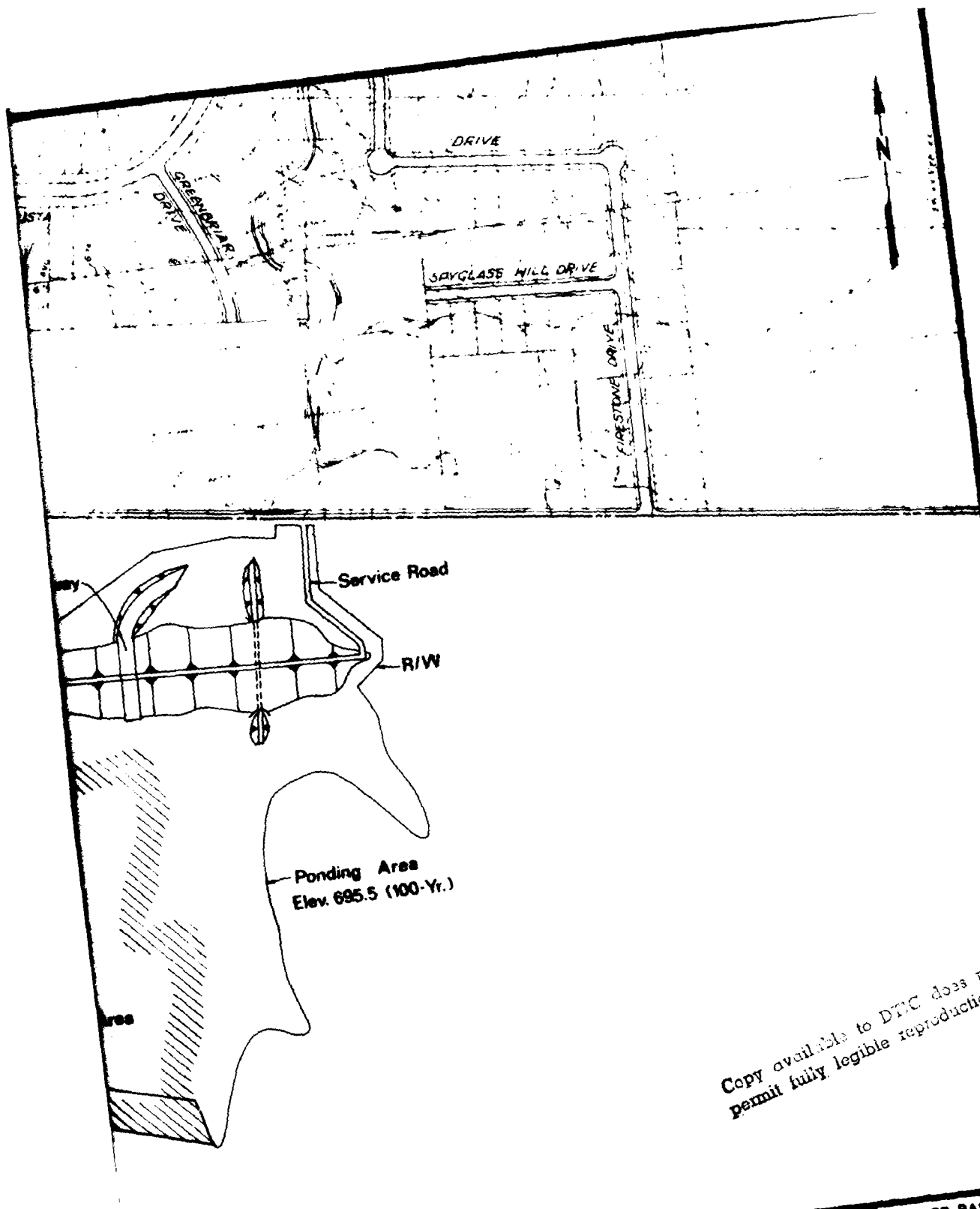
MIAMI RIVER BASIN
FAIRFIELD, OHIO

**DRY BED RESERVOIR
SITE "C"**

LOUISVILLE DISTRICT
CORPS OF ENGINEERS
JULY 1981

SHEET 5 OF 6 PLATE





Copy available to DTC does not
permit fully legible reproduction.



MIAMI RIVER BASIN
FAIRFIELD, OHIO

DRY BED RESERVOIR
SITE "D"

LOUISVILLE DISTRICT
CORPS OF ENGINEERS
JULY 1981

DRAFT

ENVIRONMENTAL IMPACT STATEMENT

Fairfield, Ohio)

U.S. Army Engineer District, Louisville

ABSTRACT: The Louisville District has investigated public concerns of the Fairfield study area with respect to flood damages from Pleasant Run. Four plans to alleviate flood problems on Pleasant Run were selected for detailed study. These are: a channel improvement plan providing 35-year frequency of occurrence flood protection, two dry bed reservoir plans providing 35-year and 100-year protection, and a plan combining dry bed reservoirs with nonstructural flood control measures to provide 100-year protection. The 100-year dry bed reservoir plan has been selected as the preferred plan based on its substantial degree of protection, provisions of measures for reducing adverse environmental impacts, and net beneficial economic contributions.

SEND YOUR COMMENTS TO
THE DISTRICT ENGINEER BY DEC 21 1981

If you would like further
information on this statement,
please contact:
Chief, Environmental Analysis Br.
U.S. Army Engineer District,
Louisville
P.O. Box 59
Louisville, Kentucky 40201
Commercial Telephone:
(502) 582-5696
FTS Telephone: 352-5696

NOTE: Information, displays, maps, etc. discussed in the Fairfield, Ohio Main Report are incorporated by reference in the Environmental Impact Statement.

SUMMARY

Major Conclusions and Findings

Four alternative plans have been considered to relieve flood problems along Pleasant Run at Fairfield, Ohio. These are: a channel enlargement plan providing 35-year frequency of occurrence flood protection, two dry bed reservoir plans with limited channel improvement providing 35-year and 100-year protection, and a plan combining dry bed reservoirs with nonstructural measures to provide 100-year protection. (A 100-year frequency of occurrence flood, for example, is one that is expected to occur once in 100 years. But a 100-year flood is more a statistical term than a prediction of frequency. In fact, a 100-year flood may occur two or three times within any 100-year period.) The 100-year dry bed reservoir plan with 1.37 miles of channel enlargement has been selected as the plan which best provides a substantial degree of protection while at the same time has net beneficial economic contributions. This plan also appears to best meet all other selection factors and has been designated the Selected Plan.

The reservoir plans and channel enlargement plan would cause short term impacts during construction from erosion, sedimentation, and increased stream turbidity. Clearing for construction would cause the loss of some vegetation and its associated wildlife habitat. Aquatic life would be adversely affected by alteration of the watercourse. There are no archaeological or historical resources or threatened or endangered species which would be affected by the proposed plans. The nonstructural measures would have no significant adverse impacts. The four proposed plans would produce beneficial impacts through reduction of flood damages and decreased disruption of public facilities and services.

The following evaluations pursuant to the requirements of Executive Order 11988 on Flood Plain Management have been made:

- (1) In order to achieve the desired goal of reducing flood stages in Fairfield, the proposed action must be located in the flood plain.
- (2) Various alternatives were considered, both structural and nonstructural. The selected plan provides for a reasonable level of protection in a manner considered acceptable and desirable by the local interests.
- (3) The proposed action does not conflict with applicable State or local standards concerning flood plain protection.
- (4) The proposed action would have a minor effect on the natural and beneficial values of the flood plain. Pleasant Run flows through an urban area and much of the adjacent flood plain has been developed for residential and commercial use.
- (5) In order to minimize the impacts of the proposed action, various measures will be undertaken as part of the project's design and construction. These include the following:
 - a. Retention of as much of the existing streambank vegetation as possible (restricting channel widening to one side of the stream, where possible, for channel enlargement) and replanting the affected areas with grass, trees, and shrubs.
 - b. Disturbed areas will be seeded or planted as soon as possible after construction.
 - c. Short and long term erosion control measures will be implemented during construction.

d. Reconstructed channel will be designed with a series of structures to simulate the pools and riffles that will be destroyed by construction.

e. A low flow channel will be designed in the channel enlargement work to help prevent extreme low flow conditions.

(6) Development of this project has been coordinated with appropriate Federal, State, and local agencies and interested groups. Public meetings on the study were held in Fairfield on 20 November 1980 and 12 November 1981.

Those items of project construction which involve the discharge of dredged or fill material into navigable waters of the United States have been evaluated using guidelines promulgated by the Administrator of the Environmental Protection Agency in conjunction with the Secretary of the Army pursuant to Section 404(b) of the Clean Water Act. The Section 404 evaluation is presented in Appendix F. Based on that evaluation, the following determination and findings were made:

(1) An ecological evaluation has been made following the evaluation guidance in 40 CFR 230.4, in conjunction with the evaluation considerations in 40 CFR 230.5.

(2) Appropriate measures have been identified and incorporated in the proposed plans to minimize adverse effects on the aquatic environment as a result of the discharges.

(3) Consideration has been given to the need for the proposed activities, the availability of alternate sites, and methods of disposal that are less damaging to the environment, and such water quality standards as are appropriate and applicable by law.

(4) The proposed discharges will not affect wetlands.

Since there are no wetlands located in the project area, no action is required by Executive Order 11990, Protection of Wetlands.

In accordance with the Endangered Species Act of 1973, as amended by the Endangered Species Act of 1978, coordination with the Fish and Wildlife Service concerning the potential presence of species listed or proposed for listing as endangered has been conducted. The Fish and Wildlife Service has concluded that the project is not likely to jeopardize the continued existence of listed species.

Pursuant to the Fish and Wildlife Coordination Act, coordination has been maintained with the Fish and Wildlife Service. The draft fish and wildlife report is included in Appendix C.

The channel enlargement plan would not pose any significant hindrance to land use and water resources planning in the area. The dry bed reservoirs would remove affected lands from the possibility of future development.

All alternatives are compatible with the Southwest Ohio Water Development Plan, Miami Corridor Plan, OKI Regional Transportation and Development Plan, and OKI Open Space Plan. The bikeway along Crystal Drive and entering Nilles Road will undergo no more than temporary disturbance during the construction period. Transportation, with regard to the proposed Nilles/East River Road Project, should not be affected. The channel realignment associated with the Nilles Road project is compatible with considered actions.

No proposed industrial or commercial sites are designated in the near future for location in the immediate study area. Open space plans within the City of Fairfield include retention of that space between the high school and the High School Tributary occupied by athletic fields. All alternatives are compatible with this plan.

Areas of Controversy

No objections to flood protection measures of some sort were expressed at the public meeting. However, certain area residents were opposed to actions which would produce major disruptions of streamside property.

Unresolved Issues

No unresolved major disagreements with study area interests exist.

Relationship to Environmental Requirements

The following table displays the relationship of the alternative plans to the principal environmental laws, executive orders, policies, and land use and water resources plans.

RELATIONSHIP OF PLANS TO ENVIRONMENTAL REQUIREMENTS, PROTECTION STATUTES AND OTHER ENVIRONMENTAL REQUIREMENTS

	35-Year Channel Enlargement	35-Year Dry Bed Reservoir	100-Year Dry Bed Reservoirs	Dry Bed Reservoirs with Nonstructural Measures
<u>Federal Policies</u>				
National Environmental Policy Act			All plans in full compliance.	
Fish and Wildlife Coordination Act			All plans in partial compliance. The final fish and wildlife report is pending.	
Clean Water Act			All plans in full compliance.	
Endangered Species Act of 1973			All plans in full compliance.	
National Historic Preservation Act of 1966			All plans in full compliance.	
Clean Air Act			All plans in full compliance.	
Federal Water Project Recreation Act			All plans in full compliance.	
Land and Water Conservation Fund Act			All plans in full compliance.	
Wild and Scenic Rivers Act			All plans in full compliance.	
Flood Plain Management (E.O. 11988)			All plans in full compliance.	
Protection of Wetlands (E.O. 11990)			All plans in full compliance.	
Analysis of Impacts on Prime and Unique Farmland in EIS, CEO Memorandum, 30 August 1976			All plans in full compliance.	
State and Local Policies			All plans are compatible.	
Land Use Plans			All plans are compatible.	

TABLE OF CONTENTS

	<u>Page</u>
Cover Sheet	EIS-1
SUMMARY	EIS-2
Major Conclusions and Findings	EIS-2
Areas of Controversy	EIS-5
Unresolved Issues	EIS-6
Relationship to Environmental Requirements	EIS-6
TABLE OF CONTENTS	EIS-8
1. NEED FOR AND OBJECTIVES OF ACTION	EIS-10
Study Authority	EIS-10
Public Concerns	EIS-10
Planning Objectives	EIS-10
2. ALTERNATIVES	EIS-11
Plans Eliminated from Further Study	EIS-11
Without Conditions (No Action)	EIS-13
Plans Considered in Detail	EIS-13
Comparative Impacts of Alternatives	EIS-16
3. AFFECTED ENVIRONMENT	EIS-20
Environmental Conditions	EIS-20
Significant Resources	EIS-20
4. ENVIRONMENTAL EFFECTS	EIS-25
Soils, Erosion and Streambank Effects	EIS-25
Air Quality	EIS-25
Noise Levels	EIS-26
Water Quality	EIS-26
Vegetation	EIS-26
Wildlife	EIS-27
Aquatic Biota	EIS-28
Threatened or Endangered Species	EIS-29
Land Use	EIS-29
Transportation	EIS-30
Aesthetics	EIS-30
Recreation	EIS-30
Cultural Resources	EIS-30
5. LIST OF PREPARERS	EIS-31

6. PUBLIC INVOLVEMENT

EIS-32

Public Involvement Program
Required Coordination
Statement Recipients
Public Views and Responses

EIS-32
EIS-32
EIS-32
EIS-34

INDEX, REFERENCES AND APPENDICES

1. NEED FOR AND OBJECTIVES OF ACTION

Study Authority

1.01 The authority for this study is contained in a U.S. Senate Resolution of 31 May 1967 and in a U.S. House of Representatives Resolution of 19 October 1967. The resolutions generally directed the Corps of Engineers to consider improvements for flood control, water quality control, water supply, recreation, fish and wildlife, and other purposes in a plan for development of the water resources in the Miami River, Little Miami River, and Mill Creek Basins in Southwestern Ohio. The study at Fairfield is a part of this comprehensive study.

Public Concerns

1.02 During the late fifties and early sixties, considerable public concern was expressed over water resource problems in the Miami River Basin. Fairfield, along with several other communities, was reported by the Miami Conservancy District to have local flood problems. The Corps of Engineers was requested to conduct studies for the determination of solutions to the flood problems. The primary desire of local interests in the study area is relief from current levels of and future increases in flooding and flood damages.

Planning Objectives

1.03 The general objectives are to identify the water resource problems in the study area and to develop a range of alternatives to solve or alleviate the problems. The planning objectives are to substantially reduce flood damages and other flood related problems from Mile 0.6 to 3.52 of Pleasant Run.

2. ALTERNATIVES

Plans Eliminated from Further Study

2.01 Nonstructural Plans. A number of plans which do not involve major structures to control flood waters were considered in preliminary planning.

a. Flood plain zoning would reduce the flood damage potential in accordance with a planned program of development and land use. It was assumed that flood plain regulation ordinances would be enacted as part of the flood insurance program and would supplement any recommended course of action.

b. Local governmental agencies could adopt building code regulations that would assist in reducing future flood damages. However, some damages are unavoidable, and for other structures, or for the less affluent members of the flood plain community, the cost of compliance with building code regulations could be prohibitive.

c. The existing tax structure could be adjusted in such a manner as to make tax rates for flood plain property higher than corresponding rates for properties located off the flood plain. Such action would make new development on the flood plain less attractive, and it would tend to encourage persons currently using flood plain property to relocate. Since this measure would not solve the present problem, it received no further consideration.

d. Federally subsidized flood insurance for individual properties is now implemented in the study area: Flood insurance will not reduce or eliminate flooding, but serves only to reimburse individual property owners for losses.

e. Temporary evacuation of persons or personal property from flood prone areas when a flood threat exists was considered. This measure would not be applicable to the study area since the rapid rise of floodwaters would not allow for adequate warning.

f. Permanent evacuation of flood plain areas could be used to reduce flood damage potential. Such a measure would involve land purchase, physical removal of buildings and improvements, and relocation of population. This alternative was not satisfactory because it would be difficult, costly, and time-consuming.

g. Raising structures (first floor and higher) above a particular flood level to eliminate all or a great part of potential flood damages was considered. This approach was found to be economically infeasible.

h. Flood proofing could prevent water from entering structures up to a 100-year level of protection by installation of permanent and/or semipermanent closures and waterproofing measures. This can be accomplished by sealing exterior surfaces and placing aluminum or steel flood shields over openings prior to a flood. This type of protection would be unsuccessful unless the owner has sufficient prior warning to install the shields. This alternative was found to be economically infeasible.

2.02 Structural Plans. The following plans were considered in preliminary planning.

a. Levees and floodwalls were given brief consideration but were rejected because of the limited area available for construction and because levees would be required on both sides of the stream in many areas.

b. Diversion of flood flows from the middle or upper part of the Pleasant Run drainage area to other receiving streams was found to be impractical.

c. Several channel enlargement plans were considered but the only economically feasible plans were the plans providing protection to the 25-year and 35-year frequency levels.

d. Dry bed reservoirs, also called retarding or detention structures, were studied in combination with some channel enlargement work which is required to meet the design objectives. The plans involving

one, two, or four reservoirs were rejected because they did not provide sufficient protection in combination with satisfactory economic benefits.

Without Conditions (No Action)

2.03 Butler County is experiencing increased residential and industrial development. This is largely the result of urbanization spill-over between the Cincinnati and Dayton metropolitan areas, which is reinforced by the north-south interstate expressway system. This urbanization trend is expected to rapidly increase the use of land for residential, industrial, commercial, institutional and ~~open space~~ purposes, and correspondingly decrease vacant and agricultural land.

2.04 Flood plain zoning and the flood insurance program will reduce the expected future increase in flood damage and provide some financial relief to the area. It is expected that the flood insurance program will cause some relocation of structures out of the flood plain over a period of many years. Some structures will probably be raised and remain in the flooded area.

2.05 A number of socioeconomic problems resulting from development of the Pleasant Run Basin will continue and will most likely become more serious unless proper measures are taken. These problems include: (1) recurring flood damage to personal property and potential for loss of life and damage to utilities, roads, and other structures; (2) continued displacement of residents; (3) continued low property values and associated low tax revenues; (4) continued interruption of production; and (5) continued discouragement of new investment and maintenance investment.

Plans Considered in Detail

2.06 Pleasant Run Channel Enlargement. The 35-year channel enlargement would involve widening and deepening the channel from Stream Mile 0.60 to 3.52. Channel bottom width varies from 65 feet to 195 feet and

depths from 9 feet to 14.5 feet. Side slopes will be protected by concrete and riprap. Bridges at East River Road, Pleasant Avenue, and Nilles Road would be enlarged. See Appendix B for illustrations of this and following plans.

2.07 Under current policy, non-Federal interests are required to furnish all lands and rights-of-way, relocation assistance, and modifications to all utilities and roads. The Federal Government is responsible for project construction costs. Under a proposal in President Carter's Message to Congress on 6 June 1978, the first cost would be shared between Federal (75%), local (20%), and State (5%). The costs for operation and maintenance are 100 percent non-Federal for both cost sharing methods.

2.08 Several features to compensate for fish and wildlife losses are included in the channel plans. These features include widening the channel on one side, where possible, providing a low flow channel, constructing riffles and pools, and purchasing 5 acres of land to compensate for loss of wildlife habitat.

2.09 35-Year Three Dry Bed Reservoirs Plus Channel Enlargement. Three dry bed reservoir sites were selected in the upper Pleasant Run watershed. The dam sites would be located on High School Tributary, East Fork Tributary, and Pleasant Run. The three sites are shown on Plate 4. Physical data is provided in the Main Report. In addition to the reservoirs, some channel enlargement work is required to meet the design objectives. The channel enlargement would extend from Pleasant Run Stream Mile 3.52 to Mile 2.69 with channel bottom widths varying from 30 feet to 60 feet.

2.10 The implementation responsibilities and cost sharing for this plan are the same as for the channel enlargement plan.

2.11 The channel enlargement portion of the plan will include special compensation features similar to those which would be provided for the channel improvement plan. Recreation facilities would be provided in

conjunction with the dry bed reservoirs. The facilities would be for day use activities such as walking, jogging, bicycling, outdoor games, and limited picnicking.

2.12 100-Year Three Dry Bed Reservoirs Plus Channel Enlargement. The sites for the three dry bed reservoirs in this plan are the same as for the 35-year plan. Channel enlargement would also be provided between Mile 2.69 and 3.52 with channel bottom widths varying from 50 feet to 60 feet. Additional channel widening would be required between Mile 0.94 and Mile 1.34 and between Mile 1.72 and Mile 1.86.

2.13 Implementation responsibilities, cost sharing, compensation features, and recreation facilities would be the same as for the 35-year plan.

2.14 Three Dry Bed Reservoirs Plus Nonstructural Measures. This alternative combines the three dry bed reservoirs, as previously discussed, with flood proofing, evacuation, and relocation. The flood proofing measures would be designed to prevent flood waters from entering structures up to the 100-year future flood level. This can be accomplished by installation of permanent and/or semipermanent closures for various openings, and waterproofing the exterior either by special coating or by construction of a new exterior cutoff wall (masonry) in the case of frame structures. Flood proofing would be limited to a maximum height of 2 feet to prevent induced structural damage from excessive hydrostatic pressures. About 291 homes would require flood proofing. An additional 49 families whose homes could not be flood proofed would be relocated or evacuated; dwellings would be relocated where feasible. Relocation assistance would be provided where appropriate under the provisions of Public Law 91-646.

2.15 Implementation responsibilities for the structural components of this plan are the same as described for the previous plans. Under current policy, the costs for nonstructural measures are shared at a rate of 80 percent Federal and 20 percent non-Federal.

2.16 National Economic Development (NED) Plan. The NED plan addresses the objectives in the way which maximizes net economic benefits. It must be based on sound design and must include measures for addressing all objectives. The 35-year three dry bed reservoir plan has been designated the NED candidate plan. It has the highest net benefits and addresses all objectives.

2.17 Environmental Quality (EQ) Plan. The EQ plan addresses the objectives in the way which emphasizes aesthetic, ecological, and cultural contributions. Beneficial EQ contributions are made by preserving, maintaining, restoring, or enhancing the significant cultural and natural environmental attributes of the study area. The plan most in harmony with environmental objectives is the 100-year three dry bed reservoirs with nonstructural measures.

2.18 Selected Plan. The 100-year three dry bed reservoir plan with 1.37 miles of channel enlargement appears to best meet all selection factors. The plan provides a substantial degree of protection, has compensation measures for reducing adverse environmental impacts, and has net beneficial economic contributions.

Comparative Impacts of Alternatives

2.19 The following table displays the impacts on significant resources of the plans considered in detail and outlines plan economic characteristics. Additional comparative information on the alternatives' impacts can be found in the Main Report, Tables 10, 11, and 12.

COMPARATIVE IMPACTS OF ALTERNATIVES

Base Conditions and Alternatives	Soils, Erosion, & Streambank Effects	Air Quality	Noise Levels	Water Quality	Vegetation
Base Condition	Erosion and scouring of the flood plain due to flooding	Substandard	Typical of suburban areas	Reasonably good	Riparian and flood plain tree species and understory vegetation, old field communities, woodlots, cropland
Without Condition (No Action)	Increased erosion and scouring due to increased flooding	Decrease in air quality in the absence of effective control measures	Slight increase	Some decrease in water quality in the absence of effective control measures	Decrease in vegetation as a result of development in the study area
Channel Enlargement	Short term erosion during construction, reduced erosion and scouring of flood plain	Minor, short term decrease in air quality during construction	Short term increase during construction	Short term impact from increased turbidity, long term impacts from alteration of streambed	Clearing for construction; Preservation of 5-acre woodlot
35-Year Three Dry Bed Reservoirs Plus Channel Enlargement	Short term erosion during construction, reduced erosion and scouring of flood plain	Minor, short term decrease in air quality during construction	Short term increase during construction	Short term impact from increased turbidity, long term impacts from alteration of streambed	Clearing for construction; Preservation of 5-acre woodlot
100-Year Three Dry Bed Reservoirs Plus Channel Enlargement	Short term erosion during construction, reduced erosion and scouring of flood plain	Minor, short term decrease in air quality during construction	Short term increase during construction	Short term impact from increased turbidity, long term impacts from alteration of streambed	Clearing for construction; Preservation of 5-acre woodlot
Three Dry Bed Reservoirs Plus Nonstructural Measures	Short term erosion during construction, reduced erosion and scouring of flood plain	Minor, short term decrease in air quality during construction	Short term increase during construction	Short term impact from increased turbidity	Clearing for construction

Base Conditions and Alternatives	Wildlife	Aquatic Biota	Threatened or Endangered Species	Land Use	Transportation
Base Conditions	A variety of songbirds, small mammals, reptiles, and amphibians present	Diverse fish fauna and healthy aquatic community	No threatened or endangered species known to exist in the area	Residential and commercial development plus agricultural and idle land	Interstate Hwy 75, several State and Federal hwy's, B&O and Penn Central Railroads
Without Condition (No Action)	Decrease in wildlife due to encroaching development	Possible adverse impacts if there is significant water quality degradation	Area will remain unconducive to threatened or endangered species	Continued urbanization	Increased intra-area travel
Channel Enlargement	Adverse impacts from elimination of habitat	Adverse impacts from alteration of the watercourse, most impacts short term due to design features	No impact	Portions of most lots along the stream will be lost through channel construction	Short term adverse impacts during construction, long term beneficial impacts from less disruption from flooding
35-Year Dry Bed Reservoirs Plus Channel Enlargement	Elimination of habitat for reservoir and channel construction; ponding areas protected from urban development	Adverse impacts from alteration of watercourse at channelized reach but ameliorated by design features, loss of natural stream at damsites	No impact	Undeveloped areas replaced by dam sites, but ponding areas and recreation areas protected from urban encroachment	Short term adverse impacts during construction, long term beneficial impacts from less disruption from flooding
100-Year Dry Bed Reservoirs Plus Channel Enlargement	Elimination of habitat for reservoir and channel construction; ponding areas protected from urban development	Adverse impacts from alteration of watercourse at channelized reach but ameliorated by design features, loss of natural stream at damsites	No impact	Undeveloped areas replaced by dam sites, but ponding areas and recreation areas protected from urban encroachment	Short term adverse impacts during construction, long term beneficial impacts from less disruption from flooding
Three Dry Bed Reservoirs Plus Nonstructural Measures	Elimination of habitat for reservoir construction, ponding areas protected from urban development	Loss of natural stream at damsites	No impact	Undeveloped areas replaced by dam sites, but ponding areas and recreation areas protected from urban encroachment	Short term adverse impacts during construction, long term beneficial impacts from less disruption from flooding

Base Conditions and Alternatives	Aesthetics		Cultural Resources		Recreation		Economics	
	The area is generally aesthetically pleasing.		Five archaeological sites recorded, no significant remnants remain; no National Register of Historic Places sites		Slight use of stream for fishing, use of undeveloped areas for nature appreciation		Not applicable	
Base Conditions								
Without Condition (No action)	Degradation possible with increased population and development pressures		No change expected		Additional pressures from increased recreational demands		Not applicable	
Channel Enlargement	Adverse effects from change to artificially developed environment, beneficial effects from reduced flooding		No impact		Adverse impacts from elimination of vegetation and alteration of the watercourse, beneficial impacts from recreation facilities		Costs: \$1,000,000 Annually B/C ratio: 1.1 Net Annual Benefits: \$138,000	
35-Year Three Dry Bed Reservoirs Plus Channel Enlargement	Adverse effects from change to artificially developed environment, beneficial effects from reduced flooding and open spaces		No impact		Adverse impacts from loss of land replaced by dam structure, beneficial impacts from provision of recreation facilities and preservation of land in ponding areas		Costs: \$1,097,000 Annually B/C ratio: 1.6 Net Annual Benefits: \$708,000	
100-Year Three Dry Bed Reservoirs Plus Channel Enlargement	Adverse effects from change to artificially developed environment, beneficial effects from reduced flooding and open spaces		No impact		Adverse impacts from loss of land replaced by dam structure, beneficial impacts from provision of recreation facilities and preservation of land in ponding areas		Costs: \$1,244,000 Annually B/C ratio: 1.5 Net Annual Benefits: \$581,000	
Three Dry Bed Reservoirs Plus Nonstructural Measures	Adverse effects from change to artificially developed environment, beneficial effects from reduced flooding and open spaces		No impact		Adverse impacts from loss of land replaced by dam structure, beneficial impacts from provision of recreation facilities and preservation of land in ponding areas		Costs: \$1,630,000 B/C ratio: 1.2 Net Annual Benefits: \$320,000	

NOTES:

1. Base Condition Year--1980
2. Period of Analysis--50 years

3. AFFECTED ENVIRONMENT

Environmental Conditions

3.01 The study area is largely urbanized with some agricultural land and idle land. Much of the streambanks of Pleasant Run and its tributaries have good tree cover and understory vegetation. Wooded areas occur in the upper watershed. The water quality is reasonably good, and the stream supports a viable aquatic community. The study area sustains damages from periodic flooding.

Significant Resources

3.02 Soils. Soils in the Pleasant Run Basin have developed from glacial material which originated from the shale and limestone bedrock of the area. The Eldean-Ockley and Genesee-Ross Associations are the principal soil groups of the Miami River flood plain within Butler County and are predominant within the City of Fairfield and the lowland area of Pleasant Run. The upland areas of Pleasant Run and its tributaries are predominated by the Xenia-Wynn-Russell Association. The Fincastle-Patten-Xenia, Russell-Miamian-Wynn, and Wynn-Eden Associations also occur in the uplands to a lesser degree. The soils in the study area, which tend to be erodible on slopes, present few, if any, obstacles to construction. Additional soils information is provided in Appendix A and in the Soil Survey of Butler County, Ohio, and Soil Survey of Hamilton County, Ohio, USDA Soil Conservation Service.

3.03 Air Quality. Butler County air quality is monitored by the City of Cincinnati and the Southwestern Ohio Air Pollution Control District. Two monitor stations are located within the vicinity of the study area. One is in Fairfield, the other within Hamilton, Ohio. Both measure atmospheric particulates using conventional high-volume sampling procedure. The latter monitors for nitrogen dioxide, sulfur dioxide, and total oxidants. Review of 1978 sampling data shows that ambient levels of suspended particulates and total oxidants have not met Ohio standards. The United States Environmental Protection Agency designated

the City of Fairfield and Fairfield Township as nonattainment for secondary total suspended particulates and all of Butler County as nonattainment for photochemical oxidants. In general, air quality of the study area can be classified as poor.

3.04 Noise Levels. Noise levels vary throughout the Pleasant Run basin. They range from those typical of suburban areas to those of congested central business districts. Noise levels principally result from vehicular traffic.

3.05 Water Quality. Pleasant Run does not receive wastewater discharge, and water quality is sufficient to support a healthy, diverse population of fish. Ample pool-riffle development helps to enhance pollutant assimilative capacity. The lower portion of the stream, however, is subject to intermittent flow which results in degraded water quality during temporary stagnant conditions.

3.06 Vegetation. Specific biotic communities in the study area include riparian woods, woodlots, cultivated fields, and old fields.

3.07 Pleasant Run and its tributaries support typical riparian and flood plain tree species (e.g., hackberry, sycamore, black willow, mulberry, boxelder, elm, ash, silver maple, black locust, black walnut, etc.). White oak, red oak, shagbark, hickory, and sugar maple are among the upland tree species occurring in the area. Common shrubs and vines include dogwood, redbud, wild rose, honeysuckle, and grape. Ground cover is composed of a diverse group of herbaceous plant species except where lawns adjoin the stream and vegetation is limited chiefly to various ornamentals and turf grasses.

3.08 Wildlife. Vegetation in woodlots, cultivated fields, old fields, and flood plain communities, and available water provide satisfactory habitat for a diversity of wildlife. The stream wooded areas and adjoining woodlots provide good habitat for such small mammals as squirrel, raccoon, and chipmunk. Woodchuck and cottontail rabbit occur

in open areas or forest strips near open areas. A number of relatively common reptiles and amphibians are present as is a diversity of bird life.

3.09 Aquatic Biota. Pleasant Run and tributaries are typically shallow with substrate varying from limestone in upper reaches of tributaries to glacial gravel and sand in lower stream reaches. The stream has developed a considerable number of pool-riffle complexes. The lower portion of Pleasant Run, particularly the lower 1-1/2 mile or so, is subject to intermittent flows and occasionally dries up completely. Attached growths of filamentous algae are present, but aquatic plants are sparse to absent. Macroinvertebrates present include caddisfly larvae, mayfly larvae, blackfly larvae, crayfish, isopods and snails. Fish species collected from the stream include smallmouth bass, bluegill, green sunfish, black bullhead, white sucker, carp, creek chub, stoneroller, fathead minnow, and blacknose dace. Pleasant Run does not support a significant sport fishery. The stream provides spawning habitat for fish migrating from the Miami River and supplies forage fish to the river.

3.10 Threatened or Endangered Species. In accordance with the Endangered Species Act of 1973, as amended, the Louisville District requested the views of the U.S. Fish and Wildlife Service concerning the potential presence of species listed or proposed for listing as endangered. After a review of conditions in the project area, the Fish and Wildlife Service concluded that the project is not likely to jeopardize the continued existence of listed species. Additionally, no threatened or endangered species listed by the State of Ohio are known to exist in the study area.

3.11 Land Use. Fairfield is primarily an urbanized community that contains a large, rapidly growing residential area, several commercial areas, and some industrial areas. Land use in the Pleasant Run Basin is predominantly residential and commercial. Additional uses are idle land and agricultural land. Most of the agricultural land occurs near the Miami River and in the upper portions of the basin. Portions of the

agricultural land are classified as prime farmland by the U.S. Soil Conservation Service. Undeveloped land of the Pleasant Run Basin is under considerable development pressure at this time.

3.12 Transportation. Several major highways and railroads serve the Pleasant Run Basin. Interstate Highway 75 is the major north-south artery; and Interstate Highway 275 provides an east-west route. There are a number of State and Federal highways which cross the study area. The B&O and Conrail Railroads are located to the northeast. Air transportation is available via the Greater Cincinnati Airport and via the nearby Hamilton Airport. The principal mode of travel for individuals is by privately-owned vehicle.

3.13 Aesthetics. Scenic quality of the area is somewhat limited by urban development, but several scenically attractive areas occur along the stream. Only minor amounts of dumping of trash into the stream take place, and the stream is not degraded by industrial pollution. Stream aesthetics are, however, adversely affected in the lower portion of Pleasant Run during dry seasons when stagnant pools develop.

3.14 Recreation. Recreational opportunities within the immediate area of the stream are rather limited. Facilities available include the city ball park and Fairfield High School athletic fields, a roadside park at the intersection of Nilles and Hicks Roads, and the bikeway along Crystal Drive and Nilles Road. Due to the residential development along the stream, there is limited access to the stream, and no water-related recreational facilities. However, within the entire Pleasant Run Basin area, there are a number of land and water based recreation facilities. Some of these include the following:

- Lyons Park
- Good Neighbors Park
- Joyce Park
- Fairfield Municipal Park
- Pleasant Run and Winter Hills Recreation Centers

3.15 Cultural Resources. Butler County is one of the richest Ohio counties in terms of prehistoric archaeological sites, particularly in the number of mounds. In Fairfield Township, previously recorded archaeological sites include 17 mounds, seven enclosures, and one prehistoric cemetery. Of these sites, four mounds and one enclosure have been recorded for the Pleasant Run flood plain. The enclosure site is located on the Pleasant Run streambank in the vicinity of Groh Lane. Due to excavation of these sites and intensive development in the area, the majority of the sites have been destroyed.

3.16 An onsite walking reconnaissance of the considered construction area was undertaken in-house by a qualified archaeologist in October 1980. Inspection of exposed creek banks, small erosional cuts, and occasional parcels of cultivated land immediately adjacent to the creek revealed no prehistoric or early historic remains. No additional archaeological investigations are recommended for this area.

3.17 Butler County, lying in the Great Miami River Valley, has been under settlement since the 18th Century. Fertile soils and flat to gently rolling land made this area a major agricultural region in the early 19th Century. To provide improved transportation to agricultural markets, the Miami and Erie Canal was built, which led to a manufacturing boom. The Miami Valley is still one of the more important industrial areas of the United States.

3.18 Investigation for historical sites in the Pleasant Run Basin provided negative results. The National Register of Historic Places has no listings in Fairfield Township. Neither the Ohio Historical Society nor the Butler County Historical Society recognize any historical sites in the study area. A possible site of historical interest is the Symmes Cemetery located just downstream of Banker Road.

4. ENVIRONMENTAL EFFECTS

Soils, Erosion, and Streambank Effects

4.01 The channel enlargement alternative for alleviating flooding along Pleasant Run will have both adverse and beneficial effects concerning soils, erosion, and the streambanks. Adverse impacts will include short term erosion due to exposure and disturbance of soil from construction and clearing activities. This erosion will result in sediment accumulation in the stream and will continue until natural vegetation is reestablished and soils are stabilized. However, reduced flooding will reduce erosion and scouring of the flood plain. Upon completion of the project, graded side slopes of the new channel will be upgraded to minimize future erosion and reduce sediment accumulations.

4.02 Construction for dry bed reservoir alternatives will cause short term increases in erosion and siltation through borrow excavation, fill placement, and channel widening. Disturbed areas will be reseeded upon construction completion.

4.03 Flood proofing measures associated with the three dry bed reservoir plus nonstructural measures alternative would have no impact.

Air Quality

4.04 Implementation of either channel enlargement or reservoir alternatives will increase the suspended particulate level as fugitive dust from construction and wind erosion of disturbed soil. The condition will persist as a short term effect only during construction; it will have no long term impact on air quality. There will be minor emissions of gaseous pollutants (hydrocarbons, carbon monoxide, nitrogen dioxide, and sulfur dioxide) from construction related vehicle operation. Again, these emissions will be generated only for a short time.

4.05 Flood proofing aspects of the alternative which includes non-structural measures would have no impact.

Noise Levels

4.06 Short term increases in noise levels in the study area from reservoir or channel improvement construction activities will occur. This will cause temporary inconvenience to local residents.

4.07 Flood proofing measures would have negligible impact.

Water Quality

4.08 Channel enlargement construction will cause short term and long term changes in water quality. These changes will occur from increased suspended sediment, increased water velocity, and effects upon the substrate. Increased turbidity as a short term impact will result from higher levels of suspended and dissolved solids within the stream. This is caused by soil disruption during construction and subsequent erosion. Impacts from the increased sediment load to Pleasant Run may extend into the Miami River for a distance downstream of the confluence point. Increased stream velocities are not expected to have any significant effect upon the Miami River since it is a much larger stream. Removal of shade trees as a result of the project would cause a long term increase in water temperature. Removal of riffles from the stream bed would cause a decrease in the dissolved oxygen concentration and corresponding pollutant assimilative capacity. Long term impacts would be reduced by construction of pools and riffles.

4.09 Short term erosion resulting from dam construction will increase the suspended sediment load of the stream. However, in time, the revegetated soil will stabilize and this effect will diminish. The dams will cause the retention of small amounts of sediment. The net effects of the dams are not expected to involve any significant long term impact upon water quality of Pleasant Run.

Vegetation

4.10 A significant adverse impact from the channel enlargement plan would occur from clearing of vegetation. This will involve removal of

riparian trees and associated plant communities. Upon construction completion, streambanks will be protected from erosion. Selective plantings in this area will help to alleviate construction impacts, but changes to the existing environment would still be evident by the reduction in species diversity. Construction of the channel enlargement alternative will produce spoil material which will require disposal or utilization. Disposal of this material in the designated areas, which cover about 60 acres, will bury some existing plant communities which are composed primarily of either cropland or grass. Other effects will involve the disruption of vegetated areas from relocation of utilities (e.g., water mains and sanitary sewerlines).

4.11 For the three dry bed reservoirs, vegetation clearing will be required in connection with the channel enlargement portion, borrow excavation, and dam fill placement. The three borrow areas cover a total of about 37 acres and are composed mainly of cropland with some old fields. Acquisition of the right-of-way for the dams, which would cover 46 acres, would necessitate the removal of about 20 acres of woods. The remaining land is mostly old fields. The reservoir alternatives would have the benefit of excluding land within the ponding areas from future development and thereby preventing future vegetation clearing in these areas. Temporary impoundment of runoff by the dams would result in occasional inundation of vegetation. Filling and draining of the reservoirs would occur in less than 24 hours, so only plant species which are very intolerant of flooding would be affected. The overall impact on vegetation from occasional inundation would be slight.

Wildlife

4.12 Channel widening with attendant vegetation clearing would cause loss of terrestrial wildlife. During construction, noise, dust, etc., will stress most wildlife. Mobile species such as birds and large mammals may leave the immediate area; however, they may be subjected to competition from other animals in the adjacent habitats. After construction, it is anticipated that this condition will reach equilibrium. Disturbed areas will be seeded which will alter species

diversity. Disposal of generated spoil material will result in habitat burial and some wildlife displacement. Yet, if properly vegetated to curb runoff sediment and airborne dust problems, this area should provide new habitat for some small animal species. An additional adverse effect will result from water main and sanitary sewerline relocations out of the construction area. This will affect vegetative communities and wildlife habitats on a short term basis.

4.13 Dam construction and associated borrow excavation will alter wildlife habitat. Animals will be displaced into adjacent habitat which may not be able to support the increased competition. Selective planting of grass, shrubbery, etc., in disturbed areas will provide new habitat with less diversity. Preservation of the land within the ponding area will protect wildlife habitat from encroachment by urban development. Impoundment of flood waters may cause loss of less mobile animal species which are unable to flee rising water levels.

Aquatic Biota

4.14 Alteration of channel for the channel enlargement will adversely affect aquatic life within Pleasant Run. Both flora and fauna will be disturbed by alteration of the present watercourse. However, riffles and pools will be reconstructed as practicable. If construction takes place in the spring, migration of certain species of fish could be disrupted. Benthic organisms and some aquatic flora will be affected by siltation. Removal of shade trees from along the stream will cause elevation of water temperature. Decreased dissolved oxygen concentration resulting from elimination of streambed characteristics (riffles, etc.) will reduce the creek's pollutant assimilative capacity. But under plans to recreate those conditions, this will not be a long term effect.

4.15 Dam construction will have short term effects upon aquatic biota through increases in siltation. Dam fill placement will eliminate sections of stream habitat. The dams will have uncontrolled outlet structures which will pose no barriers to fish migration. Periodic

impoundment and changes in the streamflow regime should not have significant effects upon the quality of aquatic habitat. The channel enlargement portion of the dry bed reservoirs alternatives would have impacts as described above.

4.16 Flood proofing measures would have no impact.

Threatened or Endangered Species

4.17 The considered plans would have no impact since threatened or endangered species are not known to exist in the area.

Land Use

4.18 Impacts to land use from channel enlargement of Pleasant run will be relatively minor, on an areal basis. However, property owners with lots adjoining the stream within stream miles 0.60 to 2.69 will be adversely affected. Widening of the stream channel will require excavation of portions of adjoining lots. Disposal of excavated material will alter 60 acres of land which is currently used for crop production or pasture.

4.19 Dam construction would require about 83 acres of land for construction right-of-way and borrow areas. Property acquired for construction and operation of the reservoirs would be permanently unavailable for private development. About 58 acres of land classified as prime farmland would be converted to other uses. This loss would also occur in the absence of project implementation through increased urbanization.

4.20 The reduction of flood hazards in the area will make currently idle land more attractive to developers for use as residential or commercial property. However, only limited opportunities exist for extensive development in flood prone areas.

Transportation

4.21 Adverse impacts to transportation from construction activities associated with channel widening or dam construction will be short term. Long term benefits resulting from less disruption of roads, bridges, and other transportation structures by flooding will enhance transportation. Physical damages to roads will be lessened, and costs will be reduced due to less traffic interruption and rerouting.

4.22 There would be no impact on transportation from flood proofing measures.

Aesthetics

4.23 Channel enlargement measures will change the existing natural setting to an artificial, manmade environment. However, flood reduction will alleviate the adverse effects upon aesthetics of the sedimentation and debris problem which now results from inundation. Similarly, dam construction will change the existing natural setting to an artificially developed environment. Preservation of pool area will enhance the aesthetics.

4.24 Flood proofing would have minimal effect on area aesthetics.

Recreation

4.25 Clearing of vegetation for channel widening and dam construction will adversely affect recreational opportunities along Pleasant run. Loss of fish habitat from channel alterations would have an adverse impact upon stream fishing. Land-based recreation opportunities would be enhanced by the recreation facilities provided with the dry bed reservoirs plans.

Cultural Resources

4.26 No significant archaeological or historical sites remain in the area to be affected by the proposed alternatives.

5. LIST OF PREPARERS

The following people were primarily responsible for preparing this Environmental Impact Statement:

<u>Name</u>	<u>Expertise</u>	<u>Experience</u>	<u>Professional Discipline</u>
Mr. Keith Hoss	EIS Coordinator	10 years, General Biologist,	Biologist Louisville District
Mr. Charles T. Riddle	Feasibility Study	12 years, Water Resources Manager	Civil Engineer Planning Louisville, Kentucky
Mr. J. Thomas Bertke	Project Manager	7 years, PEDCO Environmental, Inc. Environmental Assessment PEDCO Environmental, Inc.	Biologist

6. PUBLIC INVOLVEMENT

Public Involvement Program

6.01 The only early public meeting held near the study area was at Lebanon, 28 March 1968, and was one of three initial meetings for the parent study, Miami River, Little Miami River, and Mill Creek Basins, Ohio. However, the State, the Miami Conservancy District, the U.S. Fish and Wildlife Service, and local officials have been kept informed of efforts on studies for the project. Meetings with representatives of the Miami Conservancy District, State of Ohio, and Fairfield were held in June 1975, November 1977, and there have been numerous meetings since the 1 August 1979 flood. Their concerns and views have been incorporated into this study.

6.02 The Formulation Stage Public Meeting was held at Fairfield on 20 November 1980.

Required Coordination

6.03 Following coordination of the Draft Environmental Impact Statement with appropriate agencies, groups and individuals, a late stage public meeting will be held. Comments received on the Draft EIS and at the public meeting will be utilized in the preparation of planning reports and the Final EIS. General coordination with appropriate agencies will be continued throughout the planning process.

Statement Recipients

6.04 The following is a list of agencies, groups and individuals to whom the Draft Environmental Impact Statement is sent.

Federal Agencies

U.S. Department of Agriculture
Soil Conservation Service
Forest Service
U.S. Department of Commerce

U.S. Department of Health, Education and Welfare

U.S. Department of Housing and Urban Development

U.S. Department of the Interior

 Fish and Wildlife Service

 National Park Service

 Heritage Conservation and Recreation Service

 Environmental Project Review

U.S. Department of Labor

 Occupational Safety and Health

U.S. Department of Transportation

 Federal Highway Administration

 Federal Aviation Administration

 Federal Railroad Administration

 Coast Guard

U.S. Department of Energy

 Federal Energy Regulatory Commission

Environmental Protection Agency

Ohio River Basin Commission

Center for Disease Control

Council on Environmental Quality

U.S. Congressman from Ohio (Senators - 2; Representatives - 3)

State of Ohio

Office of the Governor (A-95 State Clearinghouse)

Department of Natural Resources

Department of Agriculture

Environmental Protection Agency

Department of Health

State Library of Ohio

Historic Preservation Officer

Department of Transportation

Local Officials

City Administrator, City of Fairfield
County Commissioner, Butler County
County Commissioner, Hamilton County
Chief Engineer, Miami Conservancy District
August First Alliance
Pleasant Run Farms Civic Association
Office of Executive Director, OKI

A "Notice of Availability" has been sent to numerous organized groups, college and public libraries, news media, businesses and individual citizens as notification of this document.

Public Views and Responses

6.05 Local interests consider flood problems to be the main concern among water resources needs. The views presented at the Formulation Stage Public Meeting ranged from objections to specific plans to support for continuation of efforts to determine the best plan. The local sponsor, the Miami Conservancy District, opposed the channel plan and nonstructural plan because of the greater disruption of local residents and less favorable economic benefits. Plans using dry bed reservoirs and limited channel improvement were supported.

INDEX, REFERENCES AND APPENDICES

SUBJECT	Environmental Impact Statement	Main Report (References Incorporated)	Report Appendices (References Incorporated)
Aesthetics	p. EIS-23 para. 3.13		
Affected Environment	pp. EIS-20-24 para. 3.01-3.18		
Air Quality	p. EIS-20 para. 3.03		
Alternatives	pp. EIS-11-14 para. 2.01-2.19	pp. 22-67	
Aquatic Biota	p. EIS-22 para. 3.09		
Areas of Controversy	p. EIS-5		
Comparative Impacts of Alternatives	p. EIS-16 para. 2.19	pp. 43-67	
Cover Sheet	p. EIS-1		
Cultural Resources	p. EIS-24 para. 3.15-3.18		
Environmental Conditions	p. EIS-20 para. 3.01		
Environmental Effects	pp EIS-25-30 para. 4.01-4.26	pp. 43-67	App. B
Land Use	p. EIS-22 para. 2.11		
List of Preparers	p. EIS-31		
Major Conclusions and Findings	p. EIS-2	pp. 68-75	
Need for and Objec- tives of Action	p. EIS-10 para. 1.01-1.03	pp. 1, 2, 18-20	
Noise Levels	p. EIS-21 para. 3.04		

INDEX, REFERENCES AND APPENDICES (Continued)

SUBJECT	Environmental Impact Statement	Main Report (References Incorporated)	Report Appendices (References Incorporated)
Planning Objectives	p. EIS-10 para. 1.03	pp. 18-20	
Plans Considered in Detail	pp. EIS-13-16 para. 2.06-2.18	pp. 41-67	
Plans Eliminated from Further Study	pp. EIS-11-13 para. 2.01-2.02	pp. 21-40	
Public Concerns	p. EIS-10 para. 1.02	pp. 1, 2	
Public Involvement	pp. EIS-32-34 para. 6.01-6.05		App. C
Public Involvement Program	p. EIS-32 para. 6.01-6.02	p. 2, 4	App. C
Public Views and Responses	p. EIS-34 para. 6.05	pp. 43-67	App. C
Recreation	p. EIS-23 para. 3.14		
Relationship to Environmental Requirements	p. EIS-6		
Required Coordination	p. EIS-32 para. 6.03	p. 2, 4	
Significant Resources	pp. EIS-20-24 para. 3.02-3.18		
Soils	p. EIS-20 para. 3.02		
Statement Recipients	pp. EIS-32-34 para. 6.04		
Study Authority	p. EIS-10 para. 1.01	p. 1	
Summary	pp. EIS-2-7		

INDEX, REFERENCES AND APPENDICES (Continued)

SUBJECT	Environmental Impact Statement	Main Report (References Incorporated)	Report Appendices (References Incorporated)
Table of Contents	pp. EIS-8-9		
Threatened and Endangered Species	p. EIS-22 para. 3.10		
Transportation	p. EIS-23 para. 3.12		
Unresolved Issues	p. EIS-6		
Vegetation	p. EIS-21 para. 3.06-3.07		
Water Quality	p. EIS-21 para. 3.05		
Wildlife	p. EIS-21 para. 3.08		
Without Conditions (No Action)	p. EIS-13 para. 2.03-2.05	pp. 12-15	

ATE
LMED
-8